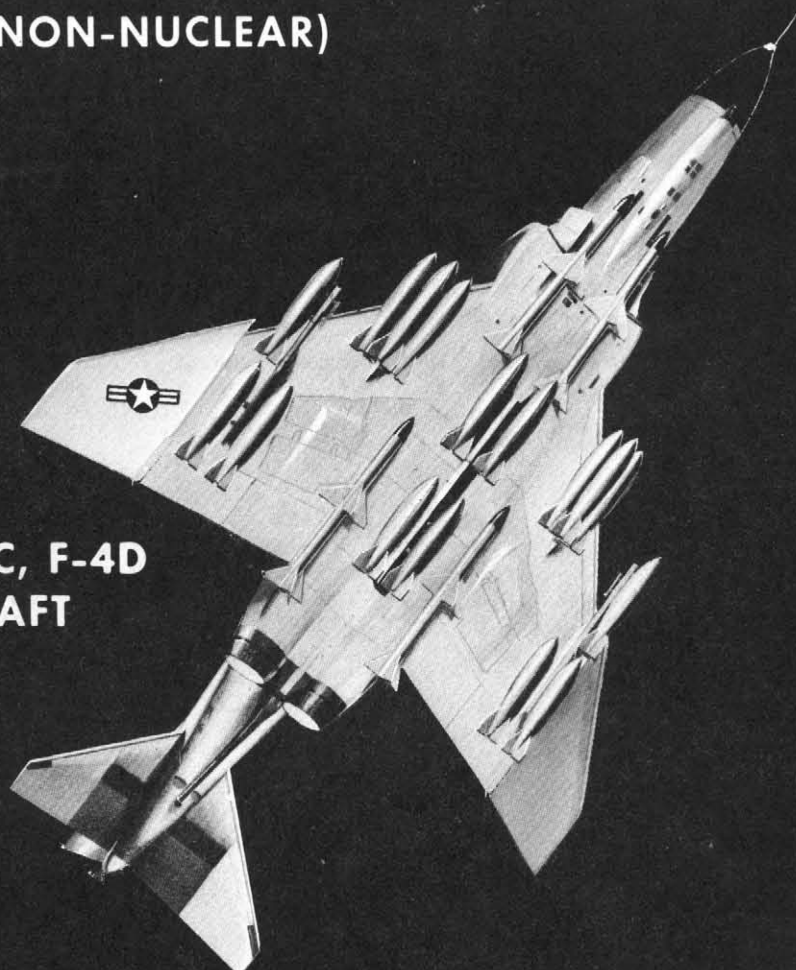
AIRCREW WEAPONS DELIVERY MANUAL (NON-NUCLEAR)



USAF SERIES F-4C, F-4D AND F-4E AIRCRAFT

MCDONNELL AIRCRAFT
NOw(A)63-0032-i
N00019-71-C-0213

This manual is incomplete without T.O.1F-4C-34-1-1-1, T.O.1F-4C-34-1-1-2 and is augmented by T.O.1F-4C-34-1-2.

Commanders are responsible for bringing this manual to the attenuation of all affected personnel.

Published under authority of the Secretary of the Air Force.

4C-34-1-1-(1)

15 MARCH 1970
CHANGE 9 - 26 JANUARY 1973

AIR FORCE - 16 February 1973 - 3100

LIST OF EFFECTIVE PAGES

Insert latest changed pages; dispose of superseded pages in accordance with applicable regulations.

NOTE: On a changed page, the portion of the text affected by the latest change is indicated by a vertical line, or other change symbol, in the outer margin of the page.

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R.H.

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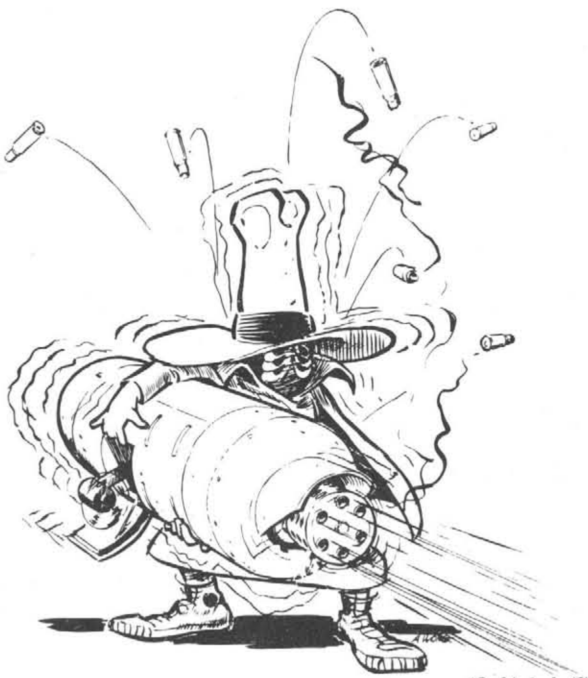
INTRODUCTION



4C-34-1-1-(2)

SCOPE

This manual contains data to plan and execute an air-to-ground or air-to-air combat attack and/or training mission using the F-4C, F-4D, and F-4E aircraft and the non-nuclear weapons. Weapons delivery techniques or tactics are not included except to describe a particular delivery mode or maneuver, or to support certain ballistic data. For Tactical Fighter Weapons Employment procedures and tactics, refer to Air Force Manual 3-1 (Secret Noforn). The following non-nuclear weapons and associated training equipment are included in this manual.

A/A 37U-15 Tow Target System (Modified)
A/B 45Y-1 Spray Tank
A/B 45Y-2 Spray Tank
A/B 45Y-4 Spray Tank
AGM-12B (Bullpup) Missile (formerly GAM 83)
AGM-12C/E (Bullpup) Missile
AIM-4D Training Missile
BDU-33/B (Formerly MK 76) Practice Bomb
BDU-33A/B, B/B Practice Bomb
BLU-1/B, B/B, C/B Fire Bomb, 750-lb
BLU-27/B, A/B Fire Bomb, 750-lb
BLU-52/B, A/B Chemical Bombs
BLU-76/B GP Bomb
CBU-1A/A Dispenser and Bomb
CBU-2/A, A/A, B/A, C/A Dispenser and Bomb
CBU-7A/A Dispenser and Bomb
CBU-9/A, A/A, B/A Dispenser and Practice Bomb
CBU-12/A, A/A Dispenser and Smoke Bomb
CBU-24/B, A/B, B/B, C/B Dispenser and Bomb
CBU-29/B, A/B, B/B, C/B Dispenser and Bomb
CBU-30/A Dispenser and Bomb
CBU-33/A Dispenser and Mine
CBU-34/A, A/A Dispenser and Mine
CBU-38/A, A/A Dispenser and Bomb
CBU-42/A Dispenser and Mine
CBU-46/A Dispenser and Bomb
CBU-49/B, A/B, B/B, C/B Dispenser and Bomb
CBU-52A/B, 52B/B Dispenser and Bomb
CBU-58/B Dispenser and Bomb
CBU-70/B Dispenser and Bomb
CBU-71/B Dispenser and Bomb
Combat Documentation Cameras
CTU-1A Resupply Container
Laser Guided Bombs (MK 82, MK 84, M-118)
LAU-3/A Rocket Launcher, 19-2.75-inch FFAR
LAU-32 Rocket Launcher, 7-2.75-inch FFAR
LAU-59/A Rocket Launcher, 7-2.75-inch FFAR
LAU-68A/A Rocket Launcher, 7-2.75-inch FFAR
LUU-1/B, -5/B, -6/B Target Marker
LUU-2/B Flare
MC-1 Gas Bomb, 750-lb
MK 20 Mod 2 and Mod 3 Cluster Bomb (Rockeye II)
MK 24 Flare
MK 36 Destructor
MK 82 GP Bomb (Snakeye), 500-lb
MK 82 LDGP Bomb, 500-lb
MK 83 LDGP Bomb, 1000-lb
MK 84 LDGP Bomb, 2000-lb
MK 106 Practice Bomb, 5-lb
MLU-32/B99 Flare (Brighteye)
M36E2 Cluster Incendiary

M117 GP Bomb, 750-lb
M117 (Retarded) GP Bomb, 750-lb
M117D Destructor (Retarded), 750-lb
M118 GP Bomb, 3000-lb
M129E1, E2 Leaflet Bomb, 750-lb
PAU-7/A Spray Tank
Radar Scope Camera
RMU 8/A Reel Launcher
SUU-7A/A, B/A, C/A Dispensers
SUU-13/A, A/A Dispensers
SUU-16/A and SUU-23/A Gun Pods, M61A1 Gun
SUU-20/A, A/A, B/A Bomb and Rocket Dispenser
SUU-21/A, Practice Bomb Dispenser
SUU-25A/A, B/A, C/A Flare Dispenser
SUU-30/B, A/B, B/B, C/B Dispensers
SUU-36/A Dispenser
SUU-38/A Dispenser
SUU-42/A Flare Dispenser
TDU-11/B Target Rocket (5-inch HVAR)
TDU-22A/B Tow Target
TMU-28/B Spray Tank
Umbilical Test Set (UTS) AN/AWM-19
2.75-in. FFAR (Rocket)
20mm ammunition

ASSOCIATED NONNUCLEAR WEAPON DELIVERY MANUALS

T.O. 1F-4C-34-1-1-1 (FORMERLY T.O. 1F-4C-34-1-1A)

See T.O. 1F-4C-34-1-1-1 (Confidential) for descriptive and procedural data pertaining to the following associated with F-4C, F-4D thru Blk 33, and F-4E:

AGM-45 (Shrike) Missile.
AIM-4D (Falcon) Missile.
AIM-7D (Sparrow III) Missile.
AIM-7E (Sparrow III) Missile.
AIM-7E-2 (Sparrow III) Missile.
AIM-9B (Sidewinder) Missile.
AIM-9E (Sidewinder) Missile.
ECM Pods.
F-4C/D/E Fire Control System.
Laser (IR) Guided Weapons.
Pave Knife Pod.
Radar Homing and Warning System (RHAW)
TISEO (Target Identification System, Electro-Optical)
TV (EO) Guided Weapons

T.O. 1F-4C-34-1-1-2 (FORMERLY T.O. 1F-4C-34-1-1B)

See T.O. 1F-4C-34-1-1-2 (Secret) for descriptive and procedural data pertaining to some weapons and equipment associated with F-4C, F-4D thru Block 33, and F-4E aircraft.

T.O. 1F-4C-34-1-1CL-1

See T.O. 1F-4C-34-1-1CL-1 Aircrew Weapons Delivery Checklist (Unclassified) for the abbreviated procedures contained in the following non-nuclear weapon delivery manuals:

a. T.O. 1F-4C-34-1-1.
b. T.O. 1F-4C-34-1-1-1.
c. T.O. 1F-4C-34-1-1-2.

T.O. 1F-4C-34-1-2

See T.O. 1F-4C-34-1-2 (Unclassified) for the ballistic tables of the weapons described in T.O. 1F-4C-34-1-1.

T.O. 1F-4C-34-1-2A

See T.O. 1F-4C-34-1-2A (Confidential) for the classified ballistic tables of the weapons described in T.O. 1F-4C-34-1-1.

T.O. 1F-4C-34-1-3

See T.O. 1F-4C-34-1-3 (Confidential) for descriptive and procedural data pertaining to the following weapons and equipment associated with some F-4D aircraft.

a. SUU-41B/A, -42A/A Dispensers.
b. Loran-D Navigation Equipment.

T.O. 1F-4C-34-1-3CL-1

See T.O. 1F-4C-34-1-3CL-1 (Unclassified) for the abbreviated procedures contained in T.O. 1F-4C-34-1-3.

T.O. 1F-4D-2-31

See T.O. 1F-4D-2-31 (Unclassified) for Aircraft Maintenance, Flight Operations, and Illustrated Parts Breakdown of the Coin System and Related Equipment. This manual contains the bombing tables, mission planning data, and inflight procedures associated with the ADSID-1 Normal, and Long Life ADSID (TC-425) Coin stores.

EXTERNAL STORES LIMITATIONS

See Flight Manual T.O. 1F-4C-1 (Unclassified) for the limitations associated with carrying, releasing, and jettisoning of the non-nuclear weapons. Only the external stores listed in the Flight Manual may be carried and released.

Note

Classified External Store Limitations are located in section IV of T.O. 1F-4C-34-1-1-1. The load configuration of a store having classified limits is normally unclassified and repeated in the Flight Manual T.O. 1F-4C-1.

ARRANGEMENT

Sections I, II, and III of this manual are divided into four parts according to aircraft effectivity: Part 1, F-4C; Part 2, F-4D; Part 3, F-4E; and Part 4, F-4C/D/E. This format will permit the user to reduce the size of the manual by removing the parts or sections that are not required.

SECTION I, DESCRIPTION. This section contains a description of the various weapon delivery modes, the

weapons employed and associated equipment, the multiple weapons release system, and the aircraft controls and indicators.

SECTION II, NORMAL AIRCREW PROCEDURES. The normal aircrew procedures employed in dive bombing; rocket launch, strafing, loft bombing, and practice bombing using the SUU-20/A, -20A/A Bomb and Rocket Dispenser and SUU-21A/A Bomb Dispenser are contained in this section.

SECTION III, EMERGENCY AIRCREW PROCEDURES. This section contains the emergency release procedures, the jettison procedures, and the fire fighting and evacuation data. Emergency procedures are identified by black diagonal stripes at the top corner of each page.

SECTION IV, SUPPLEMENTARY DATA. This section contains an error analysis of the various parameters that affect bombing accuracy and applicable safe separation data.

SECTION V, PLANNING PROCEDURES AND SAMPLE PROBLEMS. This section contains a description of all charts and ballistic tables used to plan a non-nuclear mission. Sample problems are provided to illustrate the use of the charts and the planning procedures as outlined in the mission planning form.

SECTION VI, PLANNING CHARTS AND TABLES. This section contains the safe escape, fuze arming, dive recovery, sight depression charts, blank mission planning forms and other data required for mission planning. All ballistic tables that provide weapon range, time of fall, etc. are contained in T.O. 1F-4C-34-1-2.

YOUR RESPONSIBILITY-LET US KNOW

Review conferences with operating personnel and a constant review of accident and flight test reports assure inclusion of the latest data in the manual. In this regard, it is essential that you do your part. Comments, corrections, and questions regarding this manual, other than deficiency reports, should be forwarded to AFATL (DLYE) Eglin Air Force Base, Florida. The Air Force Armament Laboratory is the Air Force Agency responsible for the technical content of this manual. Deficiency reports on this manual shall be forwarded in accordance with T.O. 00-5-1.

AUTHORIZATION FOR LOCAL REPRODUCTION

Local reproduction of all charts, tables, forms, and any data based on the content of this manual, the classified supplements, and the checklist is authorized.

CHECKLIST

The Aircrew Weapon Delivery Checklist, T.O. 1F-4C-34-1-1CL-1, contains the numbered and lettered normal procedures and jettison procedures contained in this manual and the classified supplements T.O. 1F-4C-34-1-1-1 and T.O. 1F-4C-34-1-1-2. Classified terms and data is omitted from the checklist. A complete and separate checklist is provided for each non-nuclear weapon and each item of practice equipment. The format permits the aircrew to reduce the volume of the checklist by removing the portions that apply to the weapons or equipment not associated with his model aircraft, mission being flown, or his crew duty (i.e., The AC need not carry the radar BIT checks, all tow target checks can be removed, etc).

CHANGE SYMBOL

The change symbol, as illustrated by the black line in the outer margin of this paragraph, indicates significant text changes made to the current change or revision. No change symbol is used to indicate changes made to illustrations. This manual will be changed every 90 days.

PUBLICATION DATE

The publication date that appears on the title page represents the currency of the data contained in the manual. When reference to this manual is made, the publication date (which includes the date of the latest change) should be used. (The publication date is not the printing or distribution date.)

WARNINGS, CAUTIONS, AND NOTES

The following definitions apply to Warnings, Cautions and Notes found throughout the manual.

WARNING

An operating procedure, practice, etc., which, if not correctly followed, could result in personal injury or loss of life.

CAUTION

An operating procedure, practice, etc., which, if not strictly observed, could result in damage or distruction to equipment.

Note

An operating procedure, condition, etc., which, is essential to highlight.

SAFETY AND OPERATIONAL SUPPLEMENT SUMMARY

The following list contains: previously cancelled or incorporated Supplements; outstanding Supplements, if any; and Supplements incorporated in this issue. In addition, space is provided to list those Supplements received since the latest issue.

NUMBER	SUBJECT OR DISPOSITION
T.O. 1F-4C-34-1-1SS-1 thru -10	Previously Incorporated.
T.O. 1F-4C-34-1-1S-1 thru -42	Previously Incorporated.

RECORD OF TIME COMPLIANCE DIRECTIVES

T.O. No.	T.O. Date	Title	Manual Change/Revision Date	EFFECTIVITY Production	EFFECTIVITY Retrofit
1F-4C-523	1 Dec 67	ECP 7015. Adds AGM-45 capability.	15 Sep 66	F-4D-24 thru 33	F-4C-15 thru 25
1F-4C-577	1 Jun 67	SST-181X. Radar Transponder (MOD 1873)	15 Jul 68	-	F-4C-15 thru 25
1F-4C-603	*	MOD 1919C. KB-18A Camera Module	1 Jan 71	-	F-4C-15 thru 25 (Less Mod 1778B aircraft)
1F-4D-507	19 Jan 68	ECP 7053. Increases the accuracy of the WRCS computer by adding vertical velocity acceleration compensator.	1 Apr 67	F-4D-27 and up F-4E	F-4D-24 thru 26
1F-4D-508	25 Aug 67	ECP 7023. Adds AIM-4D capability.	1 Apr 67	F-4D-26 (64-970) thru 33	F-4D-24 (64-929) thru 26 (64-969)
1F-4D-510	1 Jun 67	SST-181X. Radar Transponder (MOD 1873)	15 Jul 68		F-4D-24 thru 31
1F-4D-513	30 May 68	ECP 7069. Adds automatic acquisition switch to front cockpit throttle.	1 Apr 67	F-4D-32	F-4D-24 thru 31
1F-4D-514	15 Mar 68	ECP 7068. Adds optical sight reticle caging function to the ARR button.	1 Jan 68	F-4D-32 thru 33	F-4D-24 thru 31
1F-4D-516	15 May 68	ECP 7054. Adds audio tone to WRCS.	15 Sep 67	F-4D-30	F-4D-24 thru 29
1F-4D-522	1 May 68	ECP 7090. Adds Loran-D equipment, (refer to T.O. 1F-4C-34-1-3).	1 Jan 68		F-4D-32 and 33 (Selected Aircraft)
1F-4D-522 (REVISION)		Mod 2038D. Loran-D for additional F-4D's	1 Jan 71		

RECORD OF TIME COMPLIANCE DIRECTIVES (Cont)

T.O. No.	T.O. Date	Title	Manual Change/Revision Date	EFFECTIVITY Production	EFFECTIVITY Retrofit
1F-4D-525	15 Jan 71	Mod 1919. Adds KB-18A strike camera capability, RH missile well.	1 Apr 68		F-4D-24 thru 33 (Selected Aircraft)
1F-4D-555	1 Mar 72	Installation of Scan Converter Display System (See T.O. 1F-4C-34-1-1-1)	1 Sept 72		F-4D-30 thru 33
1F-4D-558	*	MOD 2269, Addition of gun pod capability on INBD wing stations (2 and 8).	1 Apr 71		F-4D-24 thru 33
1F-4D-559	*	Mod 2511. Provisions for Mark 6 Mod 0 weapon system.	1 Jan 71		F-4D-30 thru 33 Also 65-722 thru 65-727 (Less T.O. 1F-4D-523 aircraft)
1F-4E-510	1 Apr 69	SST-181X Radar Transponder (ECP 7085R1)	1 Nov 68	F-4E-43	F-4E-31 thru -42
1F-4E-516	25 Jan 71	MOD 1919E. KB-18A strike camera capability. (ECP 7146)	1 Feb 68	F-4E-45	F-4E-31 thru 43 (Selected Aircraft)
1F-4E-528	1 Oct 69	ECP 7142. Nose gun amber light off when rounds limiter sw is activated.	15 Mar 70	F-4E-41	F-4E-31 thru 40
1F-4E-534	25 Feb 71	ECP 7147. Obtain LCOSS lead compute mode with master arm sw OFF.	15 Mar 70	F-4E-41	F-4E-31 thru 40
1F-4E-540		ECP 7162 Relocate radar lights to glare shield - right side.	1 Jul 70	F-4E-44	F-4E-31 thru 43
		ECP 7124S1 Radar range scale change and Vis-Ident range indicator operates in additional radar modes.			
		ECP 912S1, R1, P1. Additional skin track indications (optical sight range bar and range rate circle).	1 Jan 70	F-4E-45 (69-7589)	F-4E-31 thru 45 (69-7588)

RECORD OF TIME COMPLIANCE DIRECTIVES (Cont)

T.O. No.	T.O. Date	Title	Manual Change/Revision Date	EFFECTIVITY Production	EFFECTIVITY Retrofit
1F-4E-556		ECP 683R2. Improved Conventional Weapons System.	15 Sep 71	F-4E-48	F-4E-31 thru 45
1F-4E-558	1 Aug 71	Mod 2569. Install KB-25/A gun sight camera.	15 Sep 71		F-4E-31 thru 49
1F-4E-559		ECP 912S2. Adds AIM-7 sweep/time delay.	1 Jun 72	F-4E-48	F-4E-31 thru 45.
1F-4E-560		ECP 7181. ADC input of angle of attack and TAS to LCOSS in lead compute mode.	15 Sep 71	F-4E-48	F-4E-31 thru 45.
		ECP 7087R2. Adds AGM-65 Maverick missile capability.	1 Jun 72	F-4E-48 (71-237)	
		ECP 7151R1. Adds Multiple Sensor Display Group (MSDG).	1 Jun 72	F-4E-48 (71-237)	
		ECP 7177. Adds Target Ident. System, Electro-Optical (TISEO).	1 Jun 72	F-4E-48 (71-237)	
1F-4E-575	15 Oct 72	Installation of AN/APX-81 Air-to-Air Identification System (MOD 2276)	15 Nov 72		F-4E-31 thru 45 F-4E-48 thru 55 (Selected aircraft)
1F-4-702	19 Jan 68	ECP 7066. Adds AJB-7/WRCS integrated system. Removes the 5000 ft. AGL maximum accurate release altitude for WRCS dive toss. Adds AN/AJB-7 gyro fast erect switch.	1 Apr 67	F-4D-32 F-4E-31	F-4D-24 thru 31
1F-4-709	1 Sep 69	ECP 7060. Prevents autopilot disengagement at "pickle" in WRCS modes of operation and retains ADI steering after "pickle" in the offset bomb mode.	1 Nov 68	F-4D-28 F-4E-31	F-4D-24 thru 27

RECORD OF TIME COMPLIANCE DIRECTIVES (Cont)

T.O. No.	T.O. Date	Title	Manual Change/Revision Date	EFFECTIVITY Production	EFFECTIVITY Retrofit
1F-4-750	*	ECP 7058 S1. Adds arming solenoids to the Aero 27A bomb rack, removes the 14-inch hooks, and provides a conventional release of single centerline bomb. Aero 27A nomenclature changes to BRU-5/A.	15 Jul 68	F-4E-41	F-4C/D/E
1F-4-820	30 Sep 71	Mod 1799. Relocates forward looking combat documentation camera to door 137R. Adds combat documentation motion picture system to F-4D.	15 Mar 70		F-4C-15 thru 23 Selected F-4D
1F-4-863	16 Jul 71	Adds switch for OUTBD station selective jettison.	15 Sep 71		F-4C-15 thru 25 F-4D-24 thru 33

*Information Not Available.

BLOCK NUMBERS

AIRCRAFT	BLOCK NUMBER	AIR FORCE SERIAL NUMBER
F-4C	-15	62-12199 and 63-7407 thru 63-7420
	-16	63-7421 thru 63-7442
	-17	63-7443 thru 63-7468
	-18	63-7469 thru 63-7526
	-19	63-7527 thru 63-7597
	-20	63-7598 thru 63-7662
	-21	63-7663 thru 63-7713 and 64-654 thru 64-672
	-22	64-673 thru 64-737
	-23	64-738 thru 64-817
	-24	64-818 thru 64-881
	-25	64-882 thru 64-928
F-4D	-24	64-929 thru 64-937
	-25	64-938 thru 64-963
	-26	64-964 thru 64-980 and 65-580 thru 65-611
	-27	65-612 thru 65-665
	-28	65-666 thru 65-770
	-29	65-771 thru 65-801 and 66-226 thru 66-283 and 66-7455 thru 66-7504
	-30	66-7505 thru 66-7650
	-31	66-7651 thru 66-7774 and 66-8685 thru 66-8698
	-32	66-8699 thru 66-8786
	-33	66-8787 thru 66-8825
F-4E	-31	66-284 thru 66-297
	-32	66-298 thru 66-338
	-33	66-339 thru 66-382 and 67-208 thru 67-219
	-34	67-220 thru 67-282
	-35	67-283 thru 67-341
	-36	67-342 thru 67-398
	-37	68-303 thru 68-365
	-38	68-366 thru 68-409
	-39	68-410 thru 68-451
	-40	68-452 thru 68-494
	-41	68-495 thru 68-538
	-42	69-236 thru 69-303
	-43	69-304 thru 69-307 and 69-7201 thru 69-7260
	44	69-7261 thru 69-7578
	45	69-7579 thru 69-7589
	48	71-224 thru 71-247
	-49	71-1070 thru 71-1093
	-50	71-1319 thru 72-138

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SECTION I DESCRIPTION

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PART 1 DESCRIPTION F-4C

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MISSION DESCRIPTION (F-4C)

DIVE BOMBING

The dive bombing tables (for single release and ripple release) provide trajectory data for the various parameters associated with delivery (figure 1-1). Consistency in the all important roll-in parameter cannot be overemphasized. The parameters of altitude, airspeed, distance from target, and power setting are preplanned to place the aircraft at a predetermined release altitude and distance from target with a predetermined bomb release velocity and attitude to effect an accurate hit. Because of the long periods of wind effect on the trajectory of the bomb, it is also important that the AC have knowledge of the magnitude of wind effect and primarily the wind velocity at release altitude.

The optical sight is used in conjunction with the altimeter and the calibrated airspeed indicator to determine the release point. The bombing tables provide the sight depression angle relative to the flight path. To obtain the actual sight setting, add the angle of attack obtained from the angle-of-attack chart. In addition to crosswind correction, the low altitude release conditions require lateral offset of the flight path to compensate for the location of the ejector racks from the aircraft centerline, and to compensate for the lateral ejection of the bomb from the ejector rack.

Several factors must be considered when determining an indicated release altitude: altitude loss during pullout, minimum aircraft ground clearance, altimeter lag, altimeter position error, and target elevation. The altimeter is set according to target pressure reduced to sea level (target altimeter setting).

Note

> Neutral rudder trim should be accomplished at the planned delivery speed. Since the turn and slip indicator in the rear cockpit is more sensitive, the pilot should assist the AC by calling the indicator display.

The bombing tables assume normal G loading for the given dive angle which can be obtained only when a wings-level, straight line flight path is maintained prior to release. The pipper should be allowed to walk toward the target or aimpoint and should arrive when the aircraft is at the release altitude and airspeed.

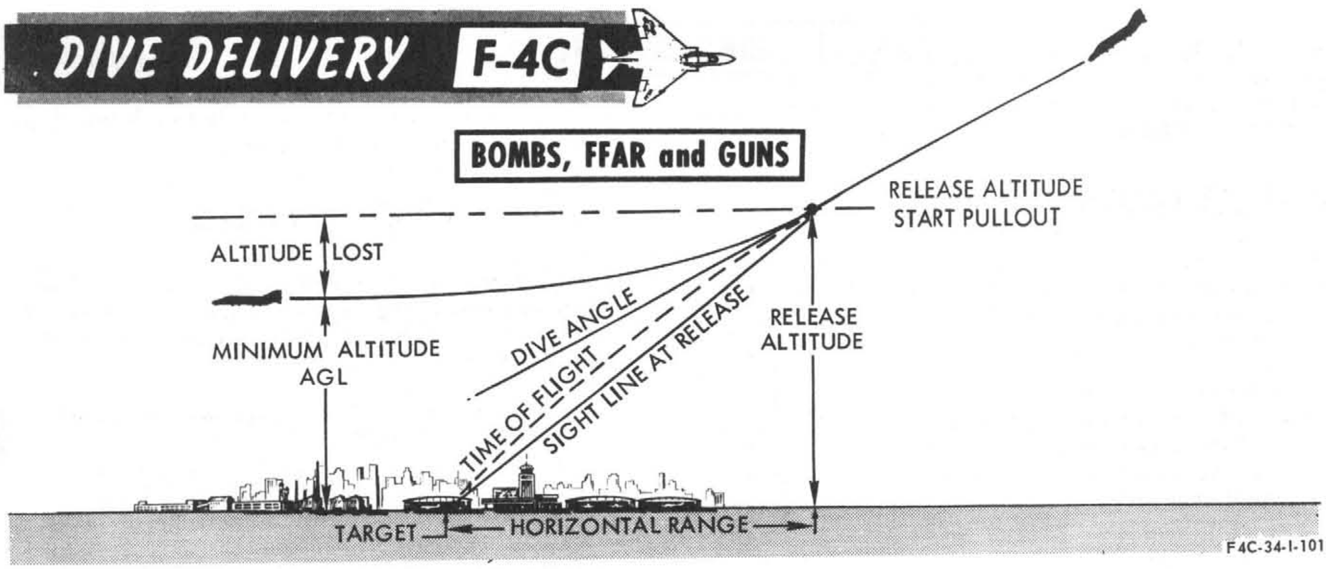


Figure 1-1

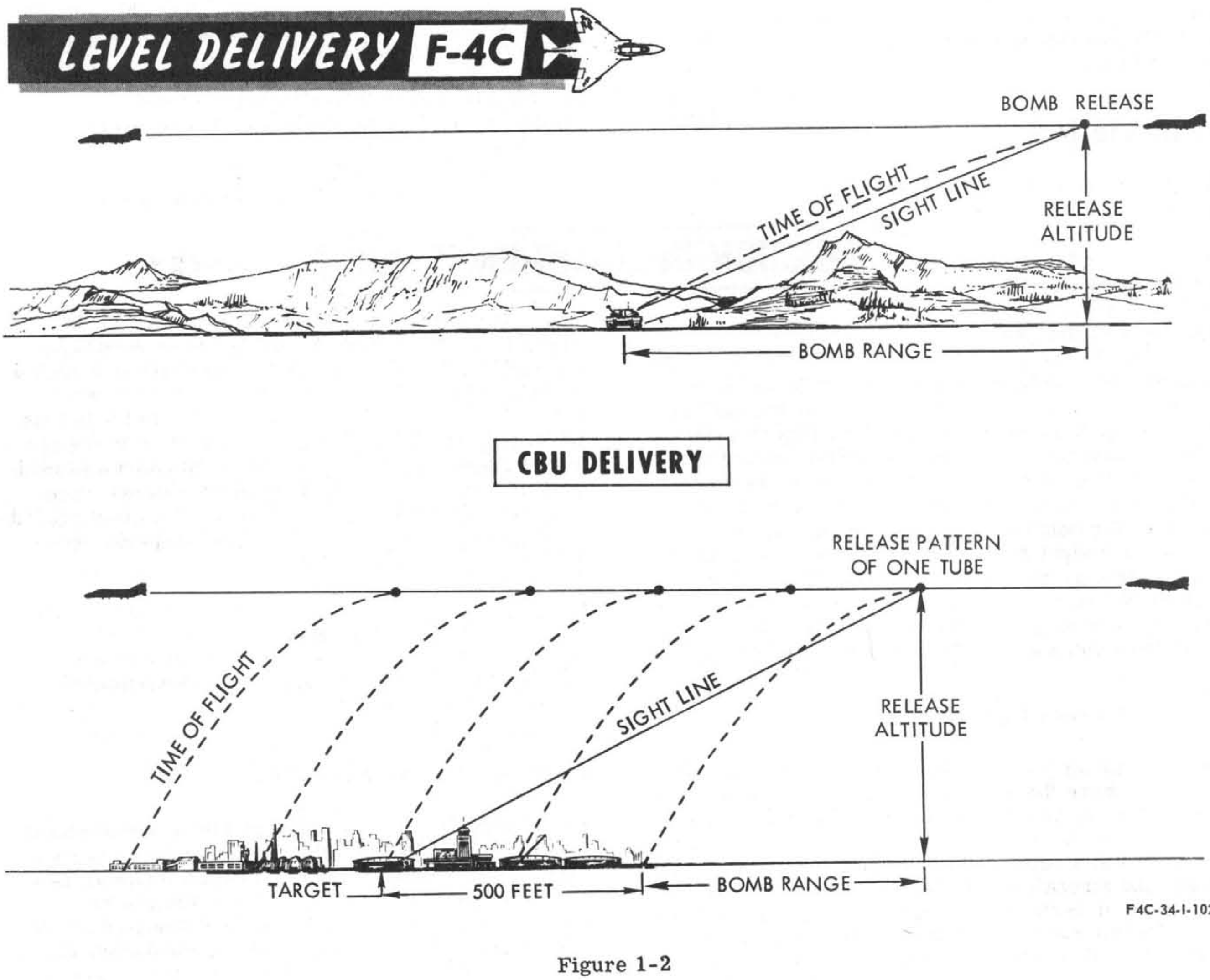


Figure 1-2

Immediately following bomb release, a preplanned pullout is initiated. If buffet is encountered the buffet boundary is maintained until the desired climb attitude is obtained.

ROCKET LAUNCH

Rocket launching (figure 1-1) requires the same considerations with respect to roll-in position, rudder trim, wind correction, release point, and pullout maneuver.

Fuze arming is not a consideration for rocket launch except when using the WDU-4/A Flechette Warhead; refer to the confidential supplement for release considerations, section V. Safe escape considerations are somewhat different in that the aircraft is flying toward the frag envelope and possible secondary explosions from the target. The safe escape tables in section VI do not consider terrain avoidance nor secondary target explosions. The effect of wind is less for rockets than for bombs because of the shorter time of flight. The rocket launch tables presented in T.O. 1F-4C-34-1-2 are valid for all rocket launchers and type of suspension equipment used. Separate launch tables are required for the various categories of warhead used with the 2.75-inch rocket motor.

GUN FIRING

Strafing with the SUU-16/A gun pod (figure 1-1) requires the same considerations with respect to roll-in position, rudder trim, wind correction, release point, and pullout maneuver. Inspection of the 20mm ballistics tables indicates sight setting variations, resulting from variations in speed and angle of attack, are smaller than for rocket firing. For strafing, variations in speed, firing altitude, and angle of attack are negligible; slant range is most important.

Safe escape consideration when firing the 20mm gun must include terrain avoidance, ricochet, and secondary target explosions. The delivery considerations for firing at a ground target are generally the same as for bombing and rocket firing. Wind correction and sight depression is less because of the projectile's shorter time of flight. Like the rocket launch tables, the sight setting is given as a function of gross weight. Refer to the description of the SUU-16/A gun pod and the 20mm ammunition.

LEVEL BOMBING

Level Bombing (figure 1-2) is a special case of dive bombing where the dive angle is zero; the delivery parameters are basically the same. The approach to the target is performed at a constant altitude, wings level, and at a stabilized airspeed. After bomb release, the aircraft may continue the approach course and speed or perform the required escape maneuver. Refer to Safe Escape, section V. The most sensitive parameters that affect bombing accuracy are the release altitude above target and pitch attitude. The method used to correct wind affects is determined by the method of target tracking (crabbed or drifting) and the type of weapon (high drag or low drag). Refer to Wind Correction, section V.

RIPPLE RELEASE BOMBING

Ripple release bombing tables are provided in T.O. 1F-4C-34-1-2. Ripple release (figure 1-3) (dive or level) delivery is identical to the single release with the following additions:

a. Safe escape and dive recovery must be based on the release altitude of the last bomb.
b. The sight setting or bomb range is computed to place the center of the impact pattern on target.
c. Wind correction is based on the time-of-fall of the first bomb released.
d. The minimum release altitude for a level ripple release is based on a straight ahead escape.
e. During the ripple release, a straight line flight path should be maintained. When the pipper is on target, the bomb button is depressed. The pipper will pass beyond the target during the ripple release. If a straight line flight path is not observed prior to and during the ripple release, the following adverse conditions can be expected:

(1) Increased dive angle.
(2) Increased altitude lost during recovery.
(3) Reduced pattern length.
(4) Reduced G-loading.
(5) Possible bomb-to-aircraft collision.

LOW DRAG BOMB DELIVERY

Level bombing tables are provided in T.O. 1F-4C-34-1-2. Lower Release altitudes can be used (i.e., 500 feet) if full military power is selected and a 4.0G pullup is initiated immediately after bomb release to attain a 20° to 30° climbing attitude. Refer to Safe Escape, section V. Crosswind correction is not required if the aircraft is crabbed to maintain a ground track through the target. Rangewind correction is not required if the bomb is released at a ground speed that is equal to the preplanned true airspeed. Refer to Wind Correction, section V.

Dive bombing tables are provided in T.O. 1F-4C-34-1-2 for all the low drag bombs and the practice bombs. Refer to Safe Escape, the Fuze Arming charts, and Dive Recovery charts to determine the minimum release altitudes.

FIRE BOMB DELIVERY

Level Bombing and dive bombing tables are provided for dive angles from 0° to 45°. The sight depression angle given in the table is computed to place the fire bomb on target; when it is desirable for the fire bomb to hit short of the target, the distance must be estimated or the sight setting recomputed using the Sight Depression charts, section VI. Wind corrections can be applied in the same manner as for the

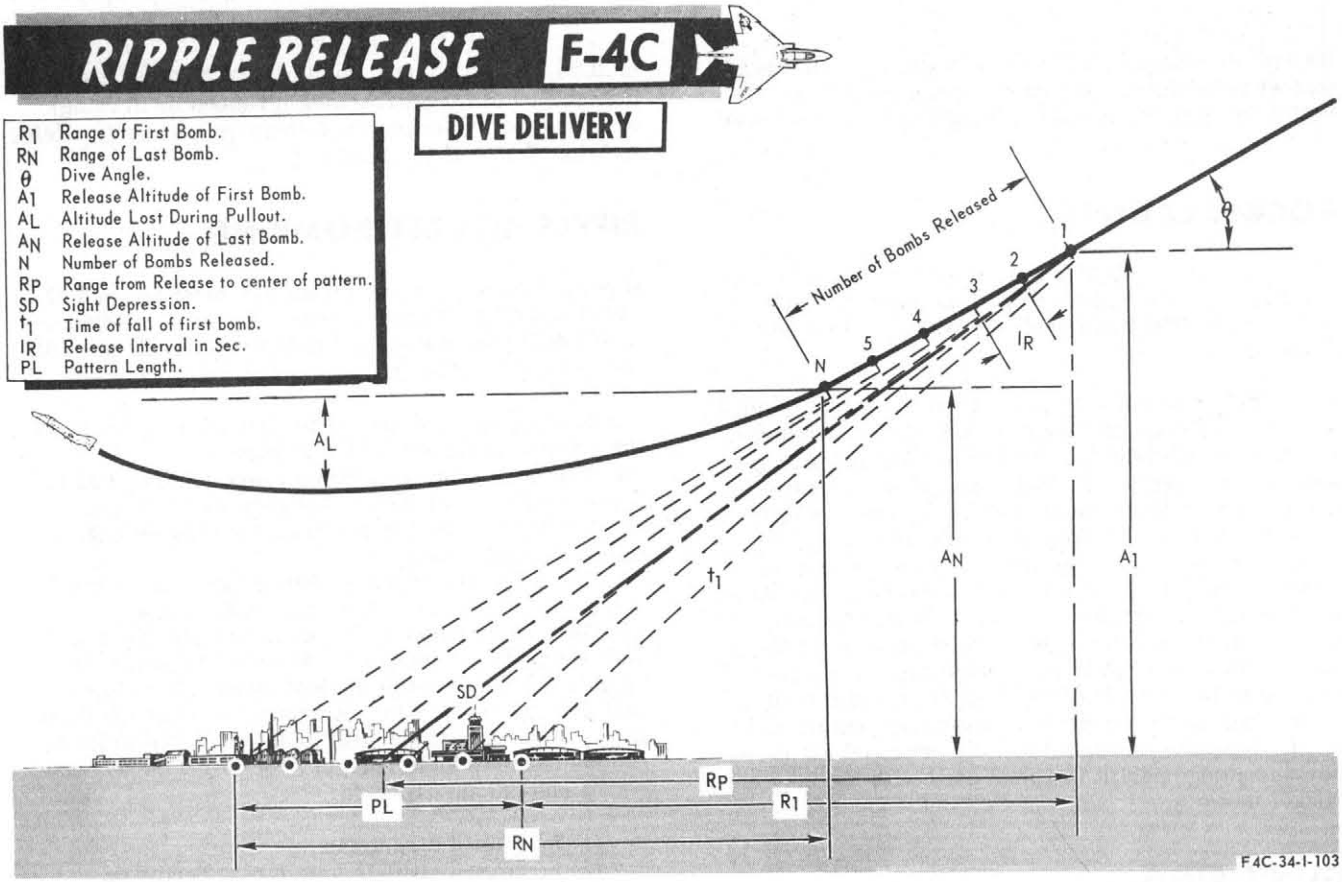


Figure 1-3

low drag bombs. Refer to Wind Corrections, section V. The Dive Recovery charts must be used to determine the minimum release altitude.

WARNING

DO NOT FLY through FIRE BOMB SMOKE within 20 seconds of burst as a compressor stall or flameout could occur.

CBU DELIVERY

The CBU delivery (figure 1-2) consists of a low level or low angle approach to target at the predetermined speed and altitude above target. Crosswind correction is applied (in addition to crabbing the aircraft) by offsetting the flight path parallel to, and upwind of the no-wind ground track. Flight path offset, to correct for crosswind, is required for the high-drag CBU munitions because of its longer time of flight. The optical sight is used to establish the release point. Rangewind correction may be ignored for the CBU delivery. The bombing tables provide the sight depression angle from flight path that will place the first bomblet 500 feet short of the target. Use the Sight Depression charts, section VI when other than 500 feet short impact is required.

When the dive delivery is used, a straight line flight path should be maintained during the release, and for 2 seconds after release; the minimum release altitude should be planned accordingly.

CBU DELIVERY USING THE SUU-7 DISPENSER

When a dive delivery is used for CBU series weapons using the SUU-7 dispenser, a straight line flight path should be maintained during the release and for 2 seconds after release. The minimum release altitude should be based on altitude lost during recovery plus altitude lost during the 2 second stabilized dive after release. This procedure is necessary to prevent voids in the bomb impact pattern whether using dispensers with or without modified tube extensions. The above procedures must be used when the dispenser is not modified with tube extensions to prevent bomb hang-up and possible subsequent early detonations.

WARNING

Do not release bombs from unmodified SUU-7 dispensers (without tube extensions) while the aircraft is in other than wings level stabilized flight.

HIGH DRAG GP BOMB DELIVERY

The high drag GP bombs can be delivered from altitudes between 100 feet to 3000 feet depending upon the bomb used, the fuzing limitation, fragmentation envelope and dive angle. The high drag characteristic provided by a retarder tail fin assembly reduces the bomb range and increases the bomb time of fall and impact angle. Single release bombing tables and ripple release bombing tables are provided in T.O. 1F-4C-34-1-2. Use the Fuze Arming and Safe Escape chart, section VI.

WARNING

DO NOT FLY over or near burst area within 20 seconds of detonation as aircraft damage can result from flying debris. During training missions, at least 20-seconds spacing between aircraft must be observed when inert or sand filled bombs are released. In the training situation, observing the 20-second spacing between aircraft prevents a bomb-to-aircraft collision in the event a bomb releases low drag and ricochets into the air after impact.

MK82 (SNAKEYE I) AND M117R HIGH/LOW DRAG OPTION, IN-FLIGHT SELECTIVITY

The MK 82 (Snakeye I) and M117R GP bombs can be released in a low drag configuration (retarding fins remain closed) or a high drag configuration (retarding fins open after release) provided arming wire routing is accomplished during loading to provide these options. The high or low drag configuration is selected in flight through the arm nose tail switch on the multiple weapons control panel. Refer to Arming Wire/Lanyard Routing, part 4, for detailed information concerning the required arming wire configuration for this capability.

For a *high drag* release using the in-flight option, the *NOSE & TAIL* position is selected on the arm nose tail switch. The *NOSE* position is selected for a low drag release with only the nose fuze initiated. After T.O. 1F-4-805, the *TAIL* position may be selected for a *high-drag* release with only the tail fuze initiated.

WARNING

Since certain mechanical and human errors inherent with this type delivery option can result in hazardous or degraded reliability situations, the operational commander should consider the following notes and warnings which point out the possibility of self inflicted damage, injury to friendly ground forces, single fuze reliability, and delivery accuracy degradation before approving this option for operational use.

Note

With the approved arming wire routing for the in-flight high/low drag option, single fuze reliability (nose fuze only) is available with the low drag option. Dual fuzing reliability (nose and tail) is available with the retarded high drag option if the high drag bomb time of fall exceeds 6.6 seconds. If the high drag bomb time of fall is less than 6.6 seconds, only FMU-54 tail fuze arming is available. Single fuze reliability (tail fuze only) is available with the high drag option when the arm nose tail switch is positioned to TAIL.

WARNING

- When the MK 82 Snakeye I or M117R bombs are configured for inflight selectivity for high/low drag releases, the minimum nose fuze setting is 6.0 seconds for the M904E2 or M904E3 fuze; the minimum tail fuze setting for the FMU-54 fuze is 2.5 seconds. With current arming time tolerances, the minimum bomb time of fall to provide time for the fuzes to arm is 6.6 seconds for the nose fuzes and 2.8 seconds for the tail fuze (high drag arming only).
- Under combat conditions, where a 6 second nose fuze arming delay setting may be inconsistent with operational requirements, a 4 second M904E2/E3 nose fuze arming delay setting may be used subject to the following restrictions:
- Dive Releases. For planned high drag dive releases, the release altitude must not exceed 1000 ft AGL.
- WRCS Dive-Toss Releases. For planned high drag dive toss releases, the pickle altitude must not exceed 1000 ft AGL.
- Level Releases. For planned level releases of high drag weapons and a straight and level escape maneuver, the release altitude must not exceed 250 ft AGL. This restriction does not apply for a single, pairs or salvo type release if a 4G wings level pullup or a 4G 60° banked turn escape maneuver is executed immediately after release.

Note

None of the foregoing restrictions apply if the planned high drag bomb release altitudes exceed the minimum release altitudes that are required for safe escape for low drag MK 82 bombs.

WARNING

With this in-flight option of high/low drag selection, strict adherence to the prescribed cockpit switchology is mandatory. If the AC inadvertently selects high drag, or experiences an arming solenoid malfunction when the intent is to release a low drag bomb, a fully armed high drag bomb would impact considerably short of the intended aimpoint. If friendlies are in the immediate area, this could result in disastrous consequences. Conversely, if the AC inadvertently selects low drag, or experiences an arming solenoid malfunction when the intent is to release a high drag bomb during close-in attack conditions, the result (if the bomb time of fall is less than 6.6 seconds) would be an unarmed bomb with an initial impact considerably downrange of the intended impact point. This could also result in disastrous consequences if friendlies are in the area; particularly if the bomb detonates, or ricochetes and then detonates. If the bomb time of fall exceeds 6.6 seconds in this case, a fully armed low drag bomb would impact considerably downrange from the intended impact point.

WARNING

- There is also a possibility of the delivery aircraft suffering self-inflicted fragment damage if an intended high drag bomb releases low drag during a close-in attack condition, and for some reason detonated at initial impact. To provide an additional margin of safety in this event, the pilot should execute a 4-G pullup or a 4-G, 60° banked escape maneuver immediately after release.
- Minimum release altitudes with respect to fragment envelope clearance should be observed even if the bomb is released SAFE. This would protect the aircrew in the event of an arming wire hang-up, solenoid malfunction, etc., resulting in an arming wire being extracted and the bomb becoming fully armed

Note

If the retarded bombs are configured to exclude any cockpit selection of a low drag munition release, a 2.0-second nose fuze arming delay setting may be used if nose fuze arming wire withdrawal is initiated by retarded fin opening action.

WARNING

If high drag ripple releases of the M117R or MK 82 Snakeye I bombs are anticipated using the in-flight high/low drag option selectivity, the munitions must be loaded in the configuration specified in T.O. 1F-4C-1 for this type release.

LEAFLET BOMB DELIVERY

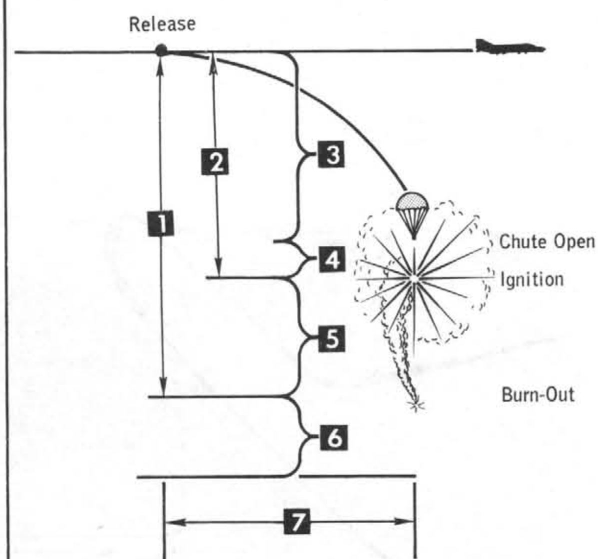
The level delivery bombing mode is used to deliver the M129E1, E2 leaflet bomb from release altitudes of 4000 feet through 11,000 feet. The bombing table in T.O. 1F-4C-34-1-2 states the bomb time of flight and range from release to burst for a given level flight release true airspeed and release altitude above target. The time of flight is used to set the mechanical time delay fuze for a 3000-foot detonation. The bomb range is used to estimate the release point.

Wind effect on the bomb prior to burst is a function of wind velocity and bomb time of flight. The wind effect on the leaflets after detonation and during descent is difficult, if not impossible to predict.

FLARE DISPENSING

The SUU-25A/A, B/A, C/A flare dispensers (figures 1-89, -90) are used to deliver the MK 24 flares. The delivery aircraft approaches the target in level flight at the preplanned release altitude. The MK 24 flare profile and parameters are illustrated in figure 1-4.

MK 24 FLARE PROFILE



1. Minimum release altitude AGL required to provide flare burnout.
2. Vertical drop prior to flare ignition.
3. Ejection fuze delay time.
4. Ignition fuze delay time.
5. Flare Burning Time:
   a. Mod 3: 180 sec.
   b. Mod 4: 198 sec.
6. Desired flare burnout height AGL.
7. Horizontal flare travel prior to ignition.

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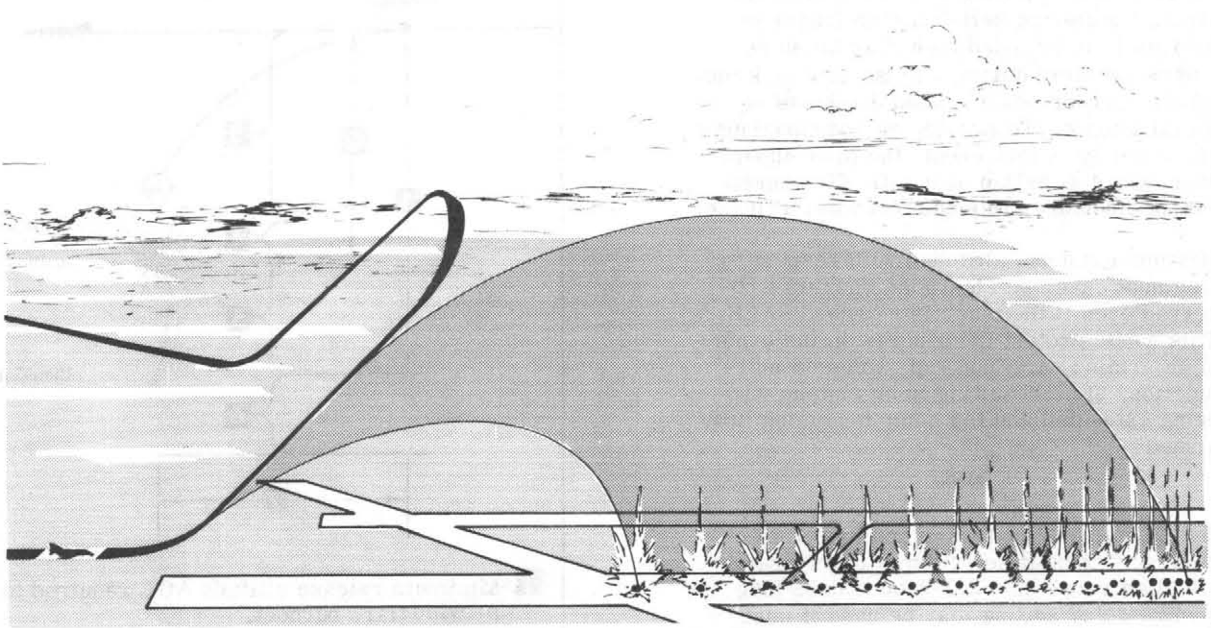
Figure 1-4

Release airspeed is not a critical parameter. Release altitude is critical only when it is desirable to have flare burnout above the ground. The flare dispensing table (T.O. 1F-4C-34-1-2) provides the minimum release altitude AGL that will provide flare burnout at impact. The desired burnout altitude AGL must be added to the minimum release altitude AGL to determine the actual release altitude AGL. The flare dispensing table also provides the horizontal distance traveled and vertical drop of the flare prior to ignition. The flare ejection fuze delay time and the flare ignition fuze delay time is set according to the mission requirements and the data on the flare dispensing table. To properly position the flare at ignition, rangewind effect and crosswind offset (ft) may be determined by multiplying the rangewind or crosswind component (kts) times 1.7 times the sum of the ejection and ignition fuze delay settings.

LOFT BOMBING F-4C



1. PRIOR TO TRP, SELECT LOFT DELIVERY MODE AND SET UP THE MULTIPLE WEAPON RELEASE MODE.
2. WHEN OVER TRP, THE AC DEPRESSES AND HOLDS THE BOMB RELEASE BUTTON TO START THE PULLUP TIMER, THE PULLUP LIGHT ILLUMINATES AND THE HORIZONTAL AND VERTICAL POINTERS ON THE ADI CENTER.
3. WHEN THE STEADY TONE SOUNDS AND THE PULLUP LIGHT GOES OUT, ADVANCE THROTTLES TO FULL MIL POWER AND BEGIN PULLUP. (WITH THE MOTOR DRIVEN TIMER INSTALLED, A 0.25-SECOND WARNING TONE IS GIVEN PRIOR TO THE STEADY PULLUP SIGNAL.) FLY TO KEEP ADI POINTERS CENTERED UNTIL BUFFET ONSET, THEN FOLLOW BUFFET BOUNDARY.
4. WHEN THE SELECTED RELEASE ANGLE IS ACHIEVED, THE PULLUP LIGHT ILLUMINATES, AND THE STEADY TONE STOPS. THE AC PLACES THE MASTER ARM SWITCH TO ARM TO INITIATE RELEASE AND CONTINUES TO HOLD THE BOMB BUTTON DEPRESSED UNTIL THE LAST BOMB IS RELEASED.
5. WHEN THE LAST BOMB IS RELEASED, INITIATE A WINGOVER TO ACHIEVE A 120° TURN WHILE DIVING TO ESCAPE AT MINIMUM ALTITUDE.

F4C-34-I-127

Figure 1-5

LOFT BOMBING

The loft bombing mode combines the use of the multiple weapons release system (MWRS) with the attitude reference and bombing computer set (ARBCS). The purpose of the loft bombing mode is to provide a ripple release capability of G.P. bombs from low altitude with a minimum of aircraft exposure time to ground-fire and without a target fly-over. This is accomplished as illustrated in figure 1-5. During mission planning, an IP (identification point) is selected on the target map, or photos, that is located near and on course to the target; the pullup point is established; the release angle of the first and last bomb, the pattern length of the bombs, and the pullup timer setting are also defined. Prior to the bombing run, the following is accomplished.

a. The multiple weapons release system is set up for a ripple release with the master arm switch in OFF.

b. The LOFT bombing mode is selected on the bomb control panel.

c. The low angle sector of the LABS bomb release angle computer is set on the release angle of the first bomb.

d. The PULLUP sector of the bombing timer is set on the IP-to-pullup time.

At the IP, the bomb button (pickle button) is depressed and must be held energized until the final bomb is released. Depressing the bomb button starts the pullup timer. At the completion of the pullup timer, a pullup signal is given and the AC begins a programmed G pullup. When the aircraft attitude is at the preselected angle, a release signal indication is supplied. This is the signal to the AC to position the master arm switch to ARM which initiates the ripple release. The AC continues the pullup until the last bomb is released. When the last bomb is rippled off, the bomb button is released, and the AC begins a wing-over escape maneuver to achieve a 120° turn while diving to escape at minimum altitude.

The following is a more descriptive analysis of the LOFT release system function. Either bomb button (front or rear cockpit) is depressed over the IP. This clutches the pullup timer and timer motor begins countdown. Bomb button power also energizes relays which illuminates the pullup light, and moves the horizontal and vertical pointers of the Attitude Director Indicator (ADI) into view over the center of

the sphere. The vertical pointer indicates yaw/roll flight deviations and the horizontal pointer shows deviations from 1.0 G flight. The appearance of the pointers indicates that the ARBCS has properly switched into the LOFT bombing function. At the end of the total time interval, pullup voltage is applied to the tone generator producing a continuous audible tone. The pullup light circuit is deenergized and the light goes off. These are direct indications to begin pullup. The AC should select MIL power and begin rotation into the pullup maneuver. As the timer circuits close, voltage is applied to one side of the low and high angle release switches which are not yet energized. Relays in the flight director bombing computer are energized to start the G programer. The ADI horizontal pointer now indicates G error based on 4 G obtained in 2 seconds. The horizontal pointer deflects upward unless the AC begins pullup.

Note

Refer to Bombing Timer (Dual Timer), this section.

When the aircraft reaches the preset pitch attitude, the release switch closes and the 28 volt dc power, previously applied at pullup, becomes the release signal. As release voltage is applied, the tone generator is deenergized, the Break light above the radar scope illuminates, and clutch voltage is removed from the timer to reset the timer and allow the pullup light to illuminate. This is the signal for the AC to position the master arm switch to ARM which initiates the ripple release mode. Bombs are released until the stations selected are empty or until the bomb button is released. The AC continues to hold the bomb button depressed and the G program continues to be displayed by the ADI horizontal pointer as an aid in completing the maneuver. The vertical pointer is deflected out of view at release.

When the AC releases the bomb button, all bombing voltage is removed and the horizontal pointer deflects out of view, the Break light and the pullup light go out. The only item remaining operational is the timer motor, which is deenergized when the bomb mode selector knob is placed to OFF.

Note

During the LOFT mode, once the bomb button is depressed, it must remain depressed until final bomb release. If the bomb button is released before the first bomb is released, an interlock circuit is energized and the run cannot be continued by depressing the bomb button. To overcome the interlock, the bomb mode selector knob must be positioned out of the LOFT function and then returned to LOFT.

The LADD bombing system can be used to perform the loft bomb delivery. This is accomplished by selecting the LADD mode on the bomb mode selector switch and setting the pullup-to-release time (from the bombing tables) on the Release Timer. The release signals are the same as for the loft bombing mode. The horizontal needle on the ADI sphere will program 3.5 G in 1.5 seconds (not 4.0 G in 2 seconds as for the loft mode) until approximately 38° pitch attitude is achieved. Therefore, the ADI cannot be used above 38° when the LADD bombing system is used to accomplish the loft delivery; the aircraft accelerometer must be used to establish the pullup acceleration.

AIRCRAFT WEAPON SYSTEM CONTROLS (F-4C)

MULTIPLE WEAPONS CONTROLS

The multiple weapons system provides the aircraft with suspension and release capabilities for various types of non-nuclear weapons. Figure 1-6 illustrates the controls and indicators.

NORMAL RELEASE SEQUENCE

The normal release sequence is shown in figure 1-7. The numbers indicate the release sequence when the station selector switch is positioned on ALL BOMBS, or when the stations are selected in the following sequence: OUTBD WING, INBD WING, CTR. If the order of station selection is not as stated, the numbered order of release will change, but the sequence (or chronological order) for the selected station remains the same. Note that when PAIRS is selected, two bombs are released with each release signal from the wings; however, the centerline station will release only one bomb, rocket pod, or dispenser with each release signal. Study the release sequence of the MER and TER racks — this never changes. The release signal steps over an empty point in the sequence shown until it reaches a loaded point or, if ALL BOMBS is selected, to another loaded station on that wing. The arm nose tail selector switch must be in NOSE & TAIL or NOSE when BOMBS are selected to provide the auto-step feature. However, this is not applicable to the MER-10A or the TER-9A racks.

Note

Refer to Suspension Equipment, this section, for MER and TER rehoming procedures.

MULTIPLE WEAPONS CONTROL PANEL

The multiple weapons control panel (figure 1-6), is directly below the front cockpit main instrument panel. It contains switches which control and select all phases of release or firing for the multiple weapons system. A brief functional description of these switches is contained in the following paragraphs.

Weapon Selector Knob

The weapon selector knob, placarded WPN SEL, is a rotary type switch with eight positions; only seven positions are used. This switch is used to select the type of munitions and method of release. The switch positions are BOMBS-SINGLE, BOMBS-PAIRS, BOMBS-RIPPLE, RKTS & DISP-SINGLE, RKTS & DISP-PAIRS, GAM-83 (AGM-12), and AGM-45.

Note

- When the SUU-21/A dispenser is loaded on the inboard stations (2 and 8), bomb release will not occur if the weapon selector knob is in RKTS & DISP. This is due to a pylon wiring modification for SUU-21/A dispenser carriage on the inboard stations only. Release or jettison of special weapons from an inboard station is not affected by this modification.
- When the weapon select knob is in the AGM-45 position, IR missile status and the audio tone is not available until the missile arm switch is in ARM.

The only automatic mode of intervalometer operation is BOMBS-RIPPLE. In the automatic mode, the bomb button is depressed and held until the bomb release sequence is complete. The manual mode requires that the bomb button be actuated for each release.

The GAM-83 (AGM-12) position supplies release power to the stations selected regardless of the type of weapon loaded on the station. If a station is selected that contains a MER or TER rack with bombs or rocket launchers, a bomb, a rocket launcher, or a dispenser will be released when the bomb release button is depressed (the rocket launcher or dispenser will not fire). The GAM-83 position produces the same effect as BOMBS-SINGLE. The converse is not true: the GAM-83 (AGM-12/B) cannot be launched by selecting BOMBS or RKTS & DISP. Refer to AGM-12 Weapon System, this section.

WARNING

Bombs or rocket launchers can be released when the weapon selector knob is in the GAM-83 position.

GAM-Auxiliary Switch

The GAM-auxiliary (GAM-AUX) switch, is a three position switch marked INTERRUPT, NORM, and TEST. The switch is in the AN/ARW-77 transmitter network and is used only when the AGM-12B, -12C, or -12E missile is aboard the aircraft. Refer to AGM-12 weapon system, this section.

Master Arm Switch

The master arm switch, placarded MA, controls the bomb button transfer relay, the arm nose tail selector switch and the station selector knob. When this switch is placed from SAFE to ARM, the transfer relay is energized and transfers the function of the bomb button from the nuclear release system to the multiple weapon system, provided the nuclear release system is not energized. The switch must be in ARM to effect firing or release of non-nuclear bombs and rockets through the normal release mode. The switch may be in either SAFE or ARM operation for the SUU-21/A dispensers. The switch receives power from the bomb arm circuit breaker, No. 1 panel.

Step Switch

The step switch is a two-position switch spring loaded to NORMAL. Placing the switch in RESET, directs the next release pulse to a left wing station. It will not step a release pulse over to the right side. To accomplish this:

a. Master arm switch - ARM
b. Weapon selector knob - BOMBS-SINGLE
c. Station selector knob - OFF
d. Step switch - RESET
   This ensures the pulse is on the left side.
e. Bomb button - DEPRESS
   The bomb button is the only method of directing the next pulse to the right wing. With the station selector knob in OFF, the possibility of an inadvertent bomb release is prevented.

Arm Nose Tail Switch

This switch (figure 1-6) completes the circuit between the master arm switch and the arming solenoids in the aircraft ejector racks (MAU-12, BRU-5/A, and MER/TER). The energized solenoids retain the arming wire swivel loops and as munitions are ejected, the arming wires are pulled to initiate the fuze arming sequence. In the SAFE position, the arming wires are retained by the munition during separation from the aircraft and the associated fuze remains SAFE.

 "All data on pages 1-10A thru 1-10B deleted."

The arm nose tail switch also provides the selective high/low drag capability for those weapons which may be rigged for either a freefall or retarded drop. In this case, the solenoids are energized to apply the holding force for the lanyards which deploy the retardation device. (Refer to M117R and MK 82 Snakeye I bombs, and Arming Wire/Lanyard Routing, part 4.)

WARNING

If this switch is used to select the M117R or MK 82 (Snakeye I) high/low drag release option in flight, the warnings and notes listed in Mission Description, High Drag GP Bomb Delivery, must be carefully observed.

The switch positions and corresponding solenoids armed are shown below.

Switch Position	Solenoid Armed
SAFE	None
NOSE	Fwd and Ctr
TAIL	Aft
NOSE & TAIL	Fwd, Ctr, and Aft

There is no center solenoid on the MER/TER and BRU-5/A ejector racks.

With MER/TER equipment that do not have automatic homing, the arm nose tail switch must be in the NOSE or NOSE & TAIL position to apply power through the sensing switch to the MER/TER stepper solenoid. Then with a partial load of bombs aboard, the empty stations are bypassed and the AC releases one bomb with each pickle signal. The TAIL position does not apply the stepping voltage and an extra pickle must be delivered to step through each empty MER/TER station.

With MER-10A and TER-9A equipment that have automatic homing, empty stations are bypassed regardless of the arm nose tail switch position.

Interval Switch

The interval switch is used only during BOMBS/RIPPLE, BOMBS/TRIPLE, and RKTS & DISP/RIPPLE modes on the weapon selector knob to establish interval between each release. The switch has three positions (0.06 SEC, 0.10 SEC, and 0.14 SEC) that determine the pulse interval: the pulse length or duration is always the same (23 to 33 milliseconds). The pulse rate is measured from the start of each pulse and therefore includes the pulse duration. The pulse rate tolerance of the various release intervals are: 60 to 90, 100 to 115, and 140 to 161 milliseconds.

Station Selector Knob

The station selector knob placarded STA SEL, is a rotary type switch with eight positions. Only five positions are used. The switch is used to select the multiple weapons station, or stations, from which the munitions are to be released or fired. The switch positions are: OFF, OUTBD WING, INBD WING, CTR, and ALL BOMBS. The OUTBD WING position for example, selects both (and only) outboard station munitions for release. The CTR position selects only the centerline munitions. Figure 1-7 shows the MER/TER release signal sequence for singles, pairs, and ripple methods, and for any station select position. The sequence for the ALL BOMBS position, however, applies only the BOMBS position on the weapon selector. When the weapon selector knob is in one of the RKTS & DISP positions, only the outboard MERS are selected; neither the rocket launchers, nor any CBU dispensers located on the inboard or centerline stations are selected by the ALL BOMBS position. The release sequence for the AGM-12 missile is described in later paragraphs. For the AGM-45A, refer to T.O. 1F-4C-34-1-1A.

Note

On F-4C aircraft that have the AGM-45 capability, a possible inadvertent conventional stores release situation exists. With a mixed load condition such as an AGM-45 or special weapon on one inboard station and with a conventional store on the other inboard station, it is possible to release the conventional store while launching the AGM-45 or special weapon. The inadvertent release possibility exists if a dual timer release mode is selected, or if an AGM-45/DIRECT launch mode is selected. Therefore, in situations where such a configuration exists, maintain the pedestal panel station select knob OFF to avoid an inadvertent release of conventional stores.

Bomb Button

Depressing the bomb button (figure 1-6) in either cockpit, applies normal release voltage for all air-

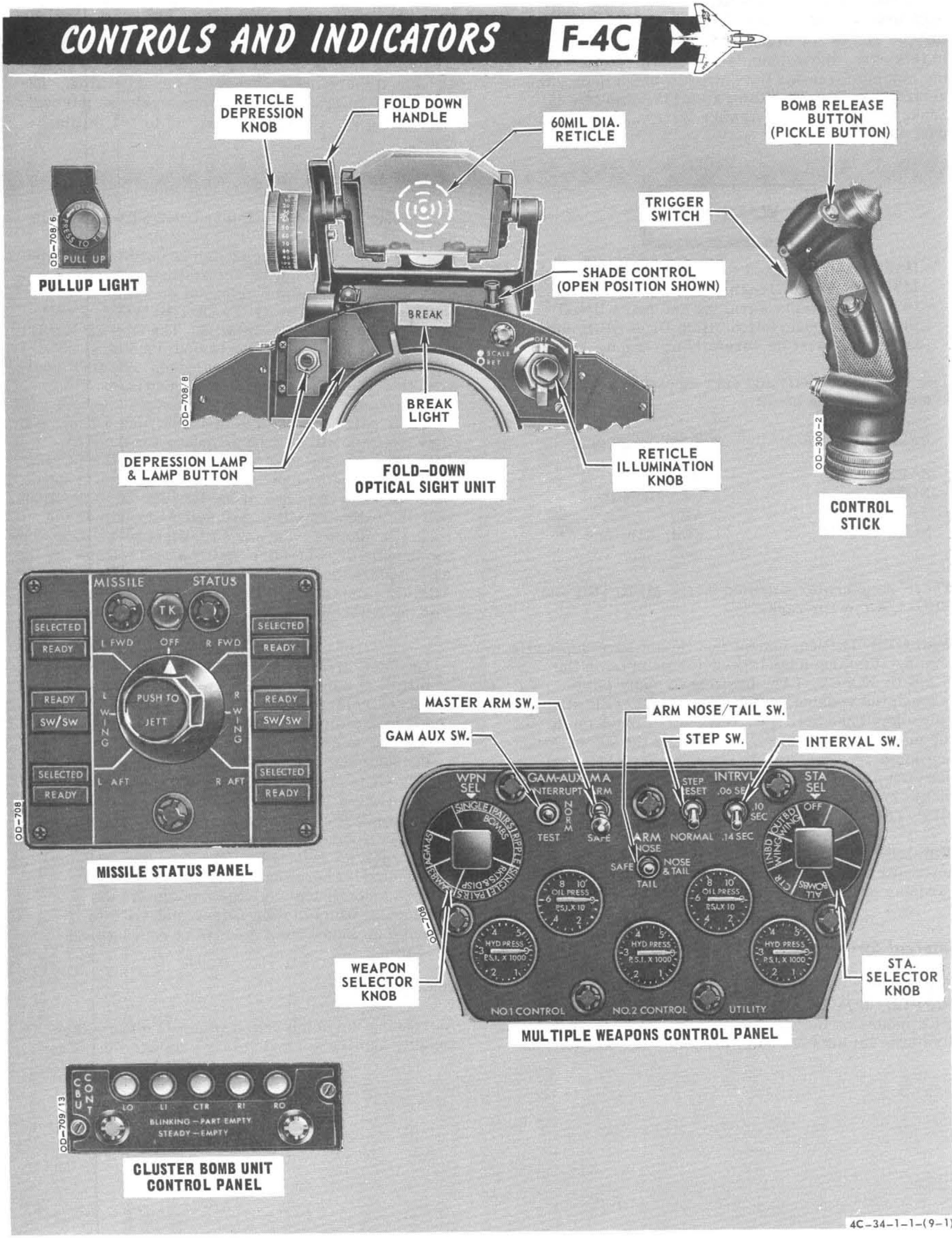


Figure 1-6 (Sheet 1 of 2)

CONTROLS & INDICATORS F-4C (CONTINUED)

Figure 1-6 (Sheet 2 of 2)

to-ground weapons selected on the multiple weapons control panel or the DCU-94/A monitor-control panel. Power can be removed from the bomb release button by pulling the A/G weapon release cont circuit breaker, No. 1 panel.

BOMB BUTTON TRANSFER RELAY

The bomb button transfer relay transfers the release signal, when energized, from the DCU-94/A panel to the multiple weapons control panel. The relay is energized when the master arm switch is positioned to ARM, provided one of the following switches is positioned AFT or SAFE:

a. DCU-94/A all station selector switches - AFT
b. DCU-94/A master release lock switch - AFT
c. Nuclear store consent switch - SAFE

CBU PANEL

The cluster bomb unit (CBU) panel (figure 1-6) is in the forward cockpit right console. It contains five station lights marked LO, LI, CTR, RI, and RO. When any dispenser on a station has two releases remaining, the light for that station begins flashing. When all the dispensers contained on a station are empty, the light illuminates steady. The CBU panel is functional only when the weapon selector knob is in RKTS & DISP, and all MER and TER stow plugs are installed. The lights are connected to the warning light dim and test circuitry when CBU's are aboard.

WARNING

The empty CBU indication establishes that all explosive detents in the CBU have been fired. The possibility of a hung bomblet(s) remaining in the tube(s) cannot be assessed by the aircrew.

Note

The TER-9A and the MER-10A do not have the CBU flasher circuits.

FOLD-DOWN OPTICAL SIGHT

The optical sight (figure 1-6) provides the AC with a visual sight reference for bombing, missile launching, strafing, and rocket firing. The sight is mounted on the top center portion of the main instrument panel and incorporates an adjustable combining glass which is used to reflect a reticle image. This reticle image consists of a 2-mil diameter pipper (aim dot), and 20, 40 and 60-mil diameter segmented circles.

Control of the reticle image is achieved by rotating the reticle depression knob located on the left side of the sight. The scale is calibrated in 2-mil units and provides angles of depression from 0 to 280 mils. The SW position, or radar boresight line, is depressed 2° (35 mils) below the fuselage reference line. The unit of measurement used to calibrate the sight is: 1° = 17.45 mils, or 1 mil = 0.0573°. The reticle image cannot be manually adjusted in azimuth.

The intensity (brightness) of the reticle image is controlled by the reticle illumination knob. Rotating the knob in either direction from OFF, controls a dual filament reticle lamp which projects the reticle image on the combining glass.

Note

The bottom filament should be used first. The bottom filament is selected by rotating the reticle illumination knob counterclockwise (left).

Optical Sight Components

The optical sight is a collimating, reflector type, optical system which provides a sight line by projecting a reticle image to infinity so that the image appears to remain in a fixed position relative to distant objects or targets. The sight basically contains the following:

a. A two-filament reticle lamp with an On/Off dimmer control.
b. A light diffusing lens.
c. A mirror mounted in a focus adjustment assembly.
d. A reticle pattern assembly.
e. An objective (collimating) lens system.
f. A reflector plate (combining glass) assembly which may be folded down.
g. A manual elevation offset system (reticle depression control).
h. A manually operated shade control.

Reticle Lamp

The reticle lamp contains two-filaments, which are illuminated individually by rotating the control knob in either direction from OFF. The magnitude of the control knob rotation in either direction controls the intensity (brightness) of the selected filament.

Diffuser Lens

The light rays from the reticle lamp are diffused by the diffuser lens to provide uniform illumination of the reticle pattern.

Reticle Pattern Assembly

The light rays from the diffuser lens pass through the reticle assembly, which contains a pattern disc. The pattern disc produces a reticle image, consisting of the 20, 40 and 60-mil diameter circles and the two-mil aim dot (also referred to as a pipper or tracking index).

Mirror Assembly

The reticle pattern is projected into the mirror assembly, focused, and reflected through the objective lens located on the top of the sight.

Collimating Lens

The objective lens collimates and projects the reticle image onto the inner surface of the combining glass. Since all light rays from any one point on the reticle image have been collimated, they emerge from the lens system as parallel rays focused at optical infinity.

CAUTION

When the sight combining glass is to be folded down, grasp the fold-down lever (figure 1-6) rather than any part of the combining glass. Otherwise, damage may occur in the depression knob gear train resulting in a considerable sight depression error.

Combining Glass

The collimated light rays from the objective lens are reflected to the eye by the combining glass (reflector plate). Since all the light rays from any one point on the reticle image are parallel, the point appears to be at an infinite distance and seems to remain in a fixed position when the AC line of vision is anywhere within the parallel rays. Light rays from a distance object, or target, are transmitted through the combining glass to the eye. Since the rays from the target are also parallel, the reticle image will appear to be superimposed on the target or object.

GUN POD CONTROLS

The SUU-16/A and SUU-23/A gun pod control switches (figure 1-6) are on the guns and sidewinder panel, the multiple weapons control panel, and the front cockpit control stick. Refer to SUU-16/A and SUU-23/A description for specific differences.

MASTER ARM SWITCH

The master arm switch is on the multiple weapons control panel. When the master arm switch is in ARM and the landing gear handle is UP, power is available at the gun station selector switches. When the master arm switch is in ARM, the bomb button transfer relay is energized if one of the three nuclear release switches is off or safe.

GUN STATION SELECTOR SWITCHES

The gun station selector switches are on the auxiliary armament control panel (guns and sidewinder panel). The outboard station selector switch controls the left and right wing gun pods. When the trigger switch is actuated, both wing station gun pods fire simultaneously. The center station switch controls the centerline gun pod. When the respective station selector switch is positioned to READY (MA switch ARM) power is supplied to the gun pod, and the ram air turbine (RAT) is extended into the airstream. When the MA switch or the station selector switch is positioned to SAFE, power continues to be applied to the gun pod while the RAT is retracting. Power is automatically removed from the gun pod when the RAT is fully retracted.

GUN CLEAR SWITCH

The gun clear switch on the guns and sidewinder panel, selects the gun mode of operation. When the auto clear mode is used, unfired rounds are extracted from the gun and ejected overboard. When the nonclear mode is used, the unfired rounds remain in the gun. The NONCLEAR position is selected when the gun is to be fired in short bursts. The gun automatically switches to auto clear mode when the last round is fired in the nonclear mode. When the guns have been fired with the gun clear switch in the NONCLEAR position and not completely fired out, a final burst must be fired with the switch positioned to AUTO CLEAR to clear the guns. If the gun is fired out with the gun clear switch in the NONCLEAR position, the bolt assemblies automatically clear.

TRIGGER SWITCH

The front cockpit trigger switch is on the control stick. When the spring-loaded switch is actuated, power is supplied to the clutch/brake solenoid to initiate gun rotation and start the ammunition feed system. The gun starts firing after the trigger switch is pulled and ceases firing after the trigger switch is released. Power can be removed from the trigger switch by pulling the gun power circuit breaker, No. 1 panel. The trigger switch in the rear cockpit is always inoperative. Refer to SUU-16/A Gun Pod, this section. For missile launching, refer to T.O. 1F-4C-34-1-1A.

WARNING

The trigger switch requires very little movement to initiate gun firing; therefore, the AC should touch the trigger only when the gun is to be fired.

TRIGGER TRANSFER RELAY

The trigger transfer relay must be energized to fire guns and must be deenergized to launch air-to-air missiles. To fire guns, the trigger transfer relay is energized by selecting guns on the auxiliary armament control panel (either center or outboard), placing the master arm switch to ARM, and closing the nose gear up limit switch (nose-gear up and locked).

Note

- The nose gear up limit switch must be energized to fire the outboard and the centerline gun pods.
- When the trigger transfer relay is energized, all missile status lights on the missile status panel go out. The TK light remains on if the tank aboard relay is energized. The tuned-up status of the missiles is not affected.

To launch air-to-air missiles, the trigger transfer relay must be deenergized; the relay is deenergized by positioning the master arm switch to SAFE.

LOFT BOMBING CONTROLS

The loft bombing delivery mode utilizes the following controls and indicators.

a. Attitude director indicator (ADI).
b. Accelerometer.
c. Pullup light.
d. Bomb release angle computer (Low Angle)
e. Bombing timer (Pullup Timer).
f. Bomb control panel.
g. Multiple weapons control panel (dog bone).
h. Bomb release button (pickle button).

ATTITUDE DIRECTOR INDICATOR (ADI)

The ADI aids the AC in establishing and maintaining a constant G pullup maneuver. The pointers are programmed to move out of center when the aircraft is not following the programmed pullup profile of 4.0 G obtained in 2 seconds and maintained thereafter, and a wings-level pullup. When the loft bombing mode is performed by using a pullup acceleration of 3.0 G obtained in 2 seconds, the ADI should not be used; use the aircraft accelerometer.

During the loft bomb run with the bomb mode switch on LOFT, the vertical and horizontal pointers program the flight path. Prior to actuating the bomb button, the vertical needle is deflected out of view if the navigation function selector knob is in the ATT position. When the bomb button is depressed, the vertical pointer centers—presenting the roll signal and indicating flight path deviations while the pullup timer is operating. At pullup, when the pullup timer is complete, the resolved yaw/roll signal is presented on the vertical pointer. If the pointer deflects to the right during the pullup, the AC rolls to the right—correcting into the pointer. The vertical director warning flag appears or disappears to indicate the degree of TACAN signal strength. Therefore, the appearance of the flap has no meaning with respect to the vertical pointer in a bombing mode.

Note

The vertical pointer on the ADI is not in the LABS yaw/roll network if the weapon selector knob is in the AGM-45 position, except when reject switch on the pedestal panel is in the DF REJ position.

The horizontal pointer is always deflected out of view unless the loft bomb run is in progress (bomb button depressed). The pointer indicates deviations in the 1.0 G flight path during the low level approach to the pullup point. When the pullup timer is complete, horizontal pointer movement represents error between the desired pullup G program and actual load factor which is measured by the accelerometer. Note that the system actually programs the proper G buildup rate, which means that if the pilot increases G loading at the proper rate, the pointer will never move from the center of the sphere. The pointer continues showing error in the constant 4.0 G flight path until the AC releases the bomb button after final bomb release.

The ADI OFF flag comes into view if: (1) a system ac or dc power failure occurs; (2) there is excessive error in the roll and pitch signal sources of the gyroscope assembly; (3) an ADI failure, or an internal dc failure within the ADI occurs. The OFF flag indicates malfunctions of the ARBCS only, regardless of the mode the AC has selected (PRIM or STBY) on the compass control panel. If the gyro system fails in some manner (as suggested by conditions 1 and 2 above), the aircrew cannot expect to obtain an accurate bomb release angle since release occurs through the ARBCS pitch-following system.

BOMB RELEASE ANGLE COMPUTER

The release angle computer contains the high and low angle release switches, the drum shaft and yaw/roll resolver, and the drogue switch. The pitch inputs drive the drum shaft which actuates the high and low angle release switches. The yaw and roll inputs are resolved, as a function of pitch, and transmitted to the flight director bombing computer for use in the vertical director pointer network. The controls on the front of the computer are available in the rear cockpit. The Low Angle control may be set from 0° to 89.9°, and the High Angle control may be set from 70° to 179.9°. Only the Low Angle control is used for loft bombing.

WARNING

When the LABS release angle gyro is set greater than 169.0°, bomb release may occur at the pullup point when the bomb button is depressed (INST O/S) or at the completion of the pullup bombing timer (TIMED O/S).

FLIGHT DIRECTOR BOMBING COMPUTER

This unit develops dc voltages, which are proportional to yaw/roll and G error, for steering indications in the loft bombing maneuver. The unit also contains the tone generator which provides the warning and pullup tone in the headset. By removing a cover plate, controls are available to set tone level, roll sensitivity, yaw sensitivity, and pitch and G error sensitivity. The sensitivity controls govern the ADI horizontal and vertical pointer rate of deflection with respect to yaw/roll and G error signals.

The flight director computer contains a roll cancel relay which is energized if roll error (yaw/heading change) exceeds 30° during the pullup flight path. With the roll cancel circuit energized, the release circuit cannot be energized and the bomb run is cancelled. To ready the system for another run, momentarily position the bomb mode switch out of the selected function than back to LOFT.

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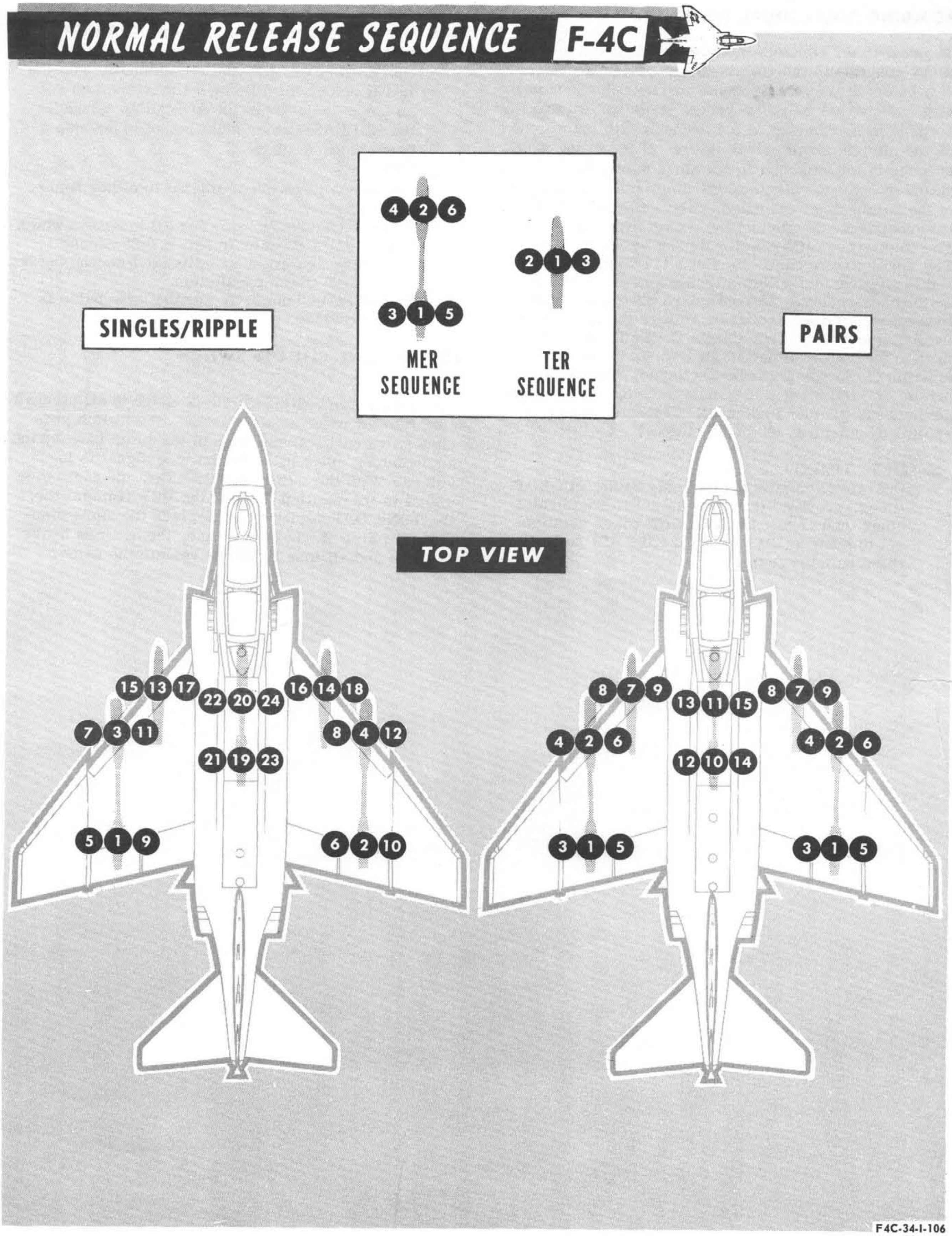

NORMAL RELEASE SEQUENCE F-4C
SINGLES/RIPPLE
PAIRS
MER SEQUENCE
TER SEQUENCE
TOP VIEW
4 2 6
3 1 5
2 1 3
15 13 17
22 20 24
16 14 18
7 3 11
8 4 12
21 19 23
5 1 9
6 2 10
8 7 9
13 11 15
8 7 9
4 2 6
12 10 14
4 2 6
3 1 5
3 1 5
F4C-34-1-106

Figure 1-7

BOMBING TIMER (DUAL TIMER)

The dual timer controls include the pullup and release timer controls in the rear cockpit. The pullup timer may be set from 0 to 60 seconds and the release timer may be set from 0 to 30 seconds. Both timers are settable in increments of 0.1 seconds with 0.1 second as the minimum numerical setting. The setting references in the windows do not move during the application of operate voltage in the bomb run. Completion of the pullup timer energizes relays which provide the various pullup signals and the pullup flight program. The timers are either motor driven or solid state. The motor driven timer receives 115 volt ac power and incorporates a pullup warning tone. The solid state timer receives 28 volt dc and has no warning tone signal. Timer excitation voltage is applied when the AC selects any mode except DIRECT. Timer initiate (operate) voltage is applied, however, as a function of the specific mode selected. To demonstrate, the following list summarizes the timer operated versus the mode selected. (Operate voltage is applied by actuating the bomb button.)

a. LOFT, TIMED O/S -
   Operate voltage is applied only to the PULLUP timer, provided the timer is set to some value other than zero. The PULLUP timer must be set to some value to energize the ADI pullup flight path program.

b. TIMED LEVEL and TIMED LADD -
   Operate voltage is applied to the PULLUP timer; then to RELEASE timer at the termination of the PULLUP timer countdown. For the LADD mode, the PULLUP timer must be set on some value to get the ADI pullup schedule; the RELEASE timer must be set to develop a bomb release signal.

c. INST O/S -
   Operate voltage is not applied to either timer.

d. Pullup Warning Tone -
   (1) Motor Driven Timer: For all modes in which the PULLUP timer is set, a 0.25 second warning tone pulse is initiated 1 second before PULLUP timer completion.
   (2) Solid State Timer: A warning tone pulse is not provided.

PULLUP TONE CUT OFF SWITCH

The pullup tone cut-off switch is added to all aircraft on the left console, rear cockpit. The switch precludes external transmission of the audio tone during any bombing mode in which the tone signal is involved. With the switch in TONE ON, the audio tone signal is transmitted through the UHF transmitter; the TONE OFF position deenergizes the same tone-transmit circuit. In either case, the aircrew hears the tone and all tone functions remain the same.

JETTISON CONTROLS (F-4C)

Note

Refer to Jettison Procedures, section III.

PYLON/SUSPENSION EQUIPMENT

The wing station (MAU-12) armament pylons cannot be jettisoned from the aircraft. The jettison controls jettison the MER, TER, or weapons suspended directly from the armament pylons. The LAU-34/A launcher, used to suspend and launch the AGM-45 and the AGM-12B, cannot be jettisoned: the jettison controls jettison the missile from the launcher without motor ignition. The LAU-7A/A launchers used to suspend and launch the AIM-9 are bolted to the inboard armament pylon and cannot be jettisoned; the applicable jettison controls launch the AIM-9 missiles or the TDU-11/B target rockets with motor ignition. When the inflight lockout pins are installed, the LO, LI and RI Unlocked lights on the DCU-94/A control-monitor illuminate. The RO Unlocked light will not illuminate when the lockout pin is installed.

EMERGENCY JETTISON

EXTERNAL STORES EMERGENCY RELEASE BUTTON

The external stores emergency release button is a momentary contact, pushbutton switch used to jettison all stations simultaneously. This control may be referred to as the panic button. The button is in the front cockpit on the left vertical panel. Jettison procedures and the conditions are contained in section III.

SELECTIVE JETTISON

CENTERLINE STATION JETTISON

The centerline station jettison switch is a cover-guarded switch on the fuel control panel. The switch has two positions: NORM and JETT. The switch is spring-loaded to NORM. Placing the switch to JETT supplies jettison voltage to the centerline station. Refer to section III, Jettison Procedures.

INBOARD WING STATION (MISSILE JETTISON SELECTOR)

The missile jettison selector knob is a rotary type pushbutton switch on the missile status panel. This switch provides selective jettison of the inboard wing stations. The switch positions are as follows: OFF, R FWD, R WING, R AFT, ALL, L AFT, L WING, and L FWD. Jettison voltage is supplied to the left or right inboard stations by selecting L WING or R WING, and pushing the jettison button. Refer to section III, Jettison Procedures.

OUTBOARD WING STATION JETTISON

The wing station jettison switch (figure 1-8) placarded WING STA JETT, is a cover-guarded, momentary contact switch, spring-loaded to NORM. The switch is on the fuel control panel. The switch has two positions: NORM and JETT. Placing the switch to JETT supplies jettison voltage to the left and right outboard wing stations. Refer to section III, Jettison Procedures.

Outboard Station Selective Jettison (After T.O. 1F-4-863)

The outboard pylon jettison select switch (figure 1-8) provides a selective jettison function for the outboard wing stations. The switch is positioned to either LEFT, RIGHT, or BOTH, and then the wing station jettison switch is energized to jettison the contents of the outboard station(s). This is actually a five-position switch with two positions not placarded. The center (straight up) position is OFF; the inboard position is not in use and is essentially another OFF position. Selecting either of these (OFF) positions disable the wing station jettison switch. The selective LEFT and RIGHT positions enable the AC to meet specific jettison limitation requirements if an unsymmetrical external store load exists on the outboard stations.

ARMAMENT SAFETY OVERRIDE PANEL

The armament safety override button is a push type switch consisting of a holding coil and three individual double pole switches ganged together by a common plunger shaft and is spring-loaded to OFF. When the override button is depressed, 28v dc is directed to the holding coil which retains the button depressed. This bypasses the interlock in the landing gear handle and the release and jettison circuits are placed in an inflight configuration.

WARNING

With the armament override button depressed, a hazard exists if a centerline station fuel tank is jettisoned on the take-off roll.

Note

If necessary during flight, the override button may be manually held depressed to effect a jettison or release.

LANDING GEAR CONTROL HANDLE

The landing gear control safety switch is integral with the landing gear control handle and is used to prevent the inadvertent application of electrical power to the armament circuits. When the gear handle is UP, this switch directs electrical power from the R 28v dc bus to the No. 1 miscellaneous relay panel, closing the armament bus relay. The armament bus relay then supplies electrical power to the armament circuits. When the gear handle is DOWN, power is applied through the safety switch to the armament safety override button holding coil; thus, the armament safety override button remains pulled in when depressed.

LEFT MAIN GEAR SCISSORS SWITCH

The left main gear scissor switch is mounted on the left main gear strut and is actuated by a cam on the bottom of the gear scissor hinge. When the strut extends, the scissor links spread and the cam rotates against the scissor switch, depressing the plunger. The scissor switch makes contact when the plunger is depressed. The switch when closed, allows electrical power to go from essential 28v dc bus to the external stores jettison switch, centerline tank jettison switch, and the nuclear weapons jettison switch. The armament safety override button bypasses the gear scissor switch and supplies electrical power to the jettison and release circuits for ground operation.

NUCLEAR STORES RELEASE AND JETTISON

Most equipment suspended from both inboard armament pylons, the left outboard armament pylon and the Aero 27A centerline bomb rack can be jettisoned through the nuclear store release circuit DIRECT release mode. This is accomplished through the DCU-94/A control monitor and the bomb release button. Refer to section III for procedures. The nuclear release circuit (DIRECT mode) will not jettison the left outboard MER when the MER is shifted aft. The nuclear jettison circuit (NUCLEAR PUSH TO JETT) will jettison a left/aft shifted outboard MER. However, the right outboard station could also jettison even though only the left outboard station is selected on the DCU-94/A.

CAUTION

In aircraft with T.O. 1F-4-801, the nuclear store release and jettison circuit should not be used for selective jettison from a particular station. The nuclear store jettison button (NUCLEAR PUSH TO JETT) should be used as a last resort, and only when the inadvertent jettison from unselected stations is of little concern. For example, the fuselage missiles may jettison and both inboard stations and CL station may jettison, even though only the right or left inboard station is selected on the DCU-94/A. Both outboard stations and CL station may jettison even though only the left outboard station is selected on the DCU-94/A. When only the centerline station is selected, only the centerline station is expected to jettison.

ECM POD JETTISON

On F-4C aircraft after T.O. 1F-4C-598, provisions for ECM pods are added on stations 2, 4, 5, 6, and 8. Prior to this, only station 9 had provisions for an

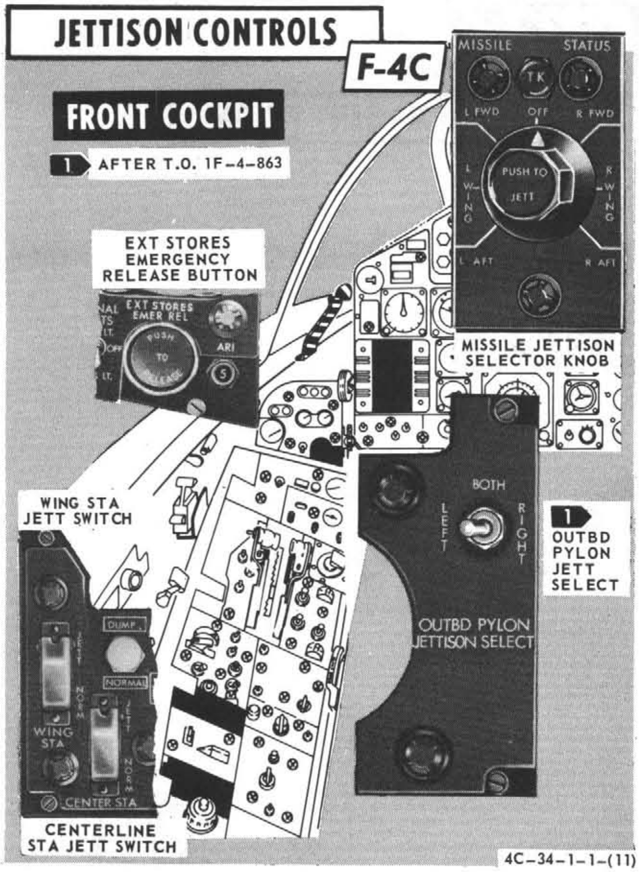


Figure 1-8

ECM pod. ECM pods on 2, 5, and 8 are jettisoned by following the normal jettison procedures for those stations. The ECM pod on station 9 is jettisoned by placing the wing tank jettison switch to JETT. After T.O. 1F-4-863, the OUTBD pylon jettison selector (figure 1-8) may be positioned to individually jettison the contents of either outboard station. ECM pods on stations 4 and 6 cannot be jettisoned.

Note

Any decision to jettison ECM pods must be left to the appropriate command authority.

MISSILE JETTISON (INBOARD WING AND FUSELAGE STATIONS)

The jettison circuitry within the firing circuits is controlled by the missile jettison knob on the missile status panel. The AC may manually select any one of the fuselage missiles or either of the inboard wing stations for jettison. AIM-7 missiles cannot be loaded or launched from the inboard armament pylons. The AIM-9 missiles can be jettisoned from the inboard missile launcher. When missile jettison knob is positioned to either the L-Wing or R-Wing and the center push to jett button is pushed, the AIM-9 missiles at the selected station are launched unguided. The inboard armament pylon cannot be jettisoned. The AIM-9 missiles can be jettisoned only when the wing flaps switch is in the UP position.

When the missile jettison knob is pushed to jettison the fuselage stations, the ejection squibs are activated any time EXT or GEN power is on the aircraft. The ejectors used to launch the fuselage missiles are activated by jettison voltage and not the fire voltage. These ejectors are gas cartridges which explode to eject the missile downward from the fuselage. The jettison circuitry for the two forward fuselage missiles is interlocked in such a manner that, if the TK light is illuminated, the missiles cannot be jettisoned. The AIM-7 missiles are jettisoned without motor ignition.

Note

After T.O. 1F-4-750, the TK light will be on before and after the M118 or MK 84 bomb is released when the centerline single bomb shorting plug is installed. Even though the TK light is on, the tank aboard relay is not energized, permitting the two forward AIM-7 missiles to be monitored, launched, and jettisoned.

SUSPENSION EQUIPMENT (F-4C)

CONVENTIONAL WEAPON SUSPENSION

The suspension equipment used for carrying all forms of conventional weapons is shown in figure 1-9. The weapons carriage capability of the aircraft may be summarized as follows:

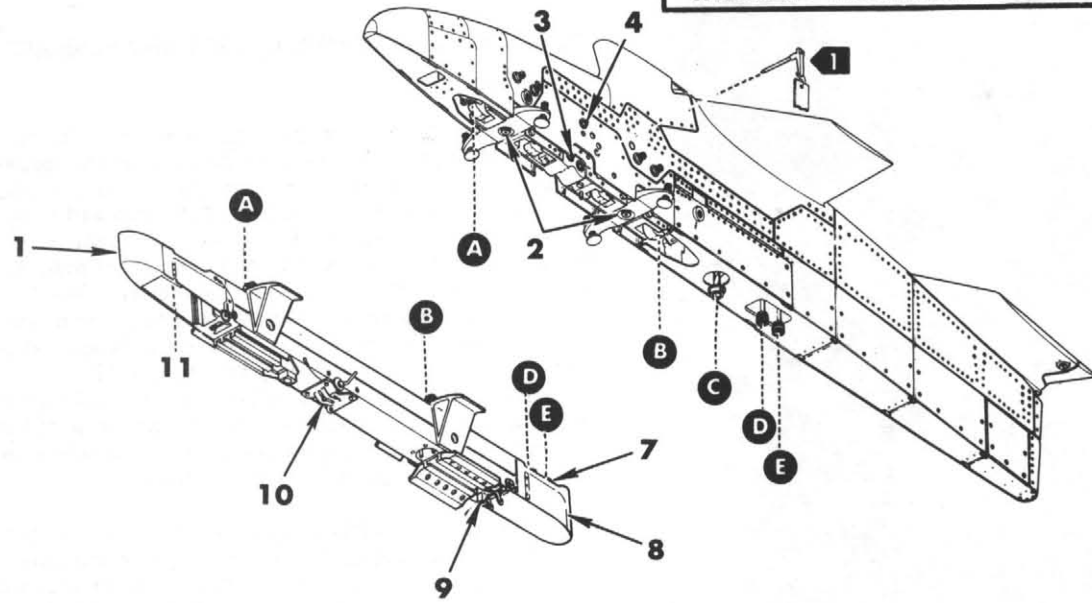
a. The centerline (CL) station BRU-5/A (AERO-27/A) rack, which receives
   (1) A single weapon; or
   (2) A CL weapons adapter, which receives either the gun pod or the MER (six station carrier) for multiple weapons carriage.
b. The left and right inboard wing (LI, RI) armament pylons which receive
   (1) A single weapon; or
   (2) The LAU-34/A launcher for AGM weapons; or
   (3) The TER (three station carrier) for multiple weapons suspension.
c. The left and right outboard wing (LO, RO) armament pylons which receive
   (1) A single weapon; or
   (2) The LAU-34/A launcher for AGM weapons; or
   (3) The MER (six station carrier) for multiple weapons suspension.

Air-to-air missile suspension equipment is described in later paragraphs. Special weapon carriage methods are described in T.O. 1F-4C-25-1.

R.H.

SUSPENSION EQUIPMENT F-4C

INBOARD ARMAMENT PYLON



1. LAU-34/A MISSILE LAUNCHER
2. EJECTOR RACK PISTON (2)
3. MAU-12 EJECTOR RACK
4. INFLIGHT SAFETY LOCKOUT PIN (BOLT)
5. (a) TRIPLE EJECTOR RACK ASSEMBLY (TER)
   (b) MULTIPLE EJECTOR RACK ASSEMBLY (MER)
6. EJECTOR RACK, MER/TER
7. AGM-12 LAUNCHER BUNDLE (FWD)
   AGM-45 LAUNCHER BUNDLE (AFT)
8. JETTISON GUN ACCESS
9. AFT MISSILE RETAINER
10. FWD MISSILE RETAINER
11. MISSILE/LAUNCHER CONNECTOR

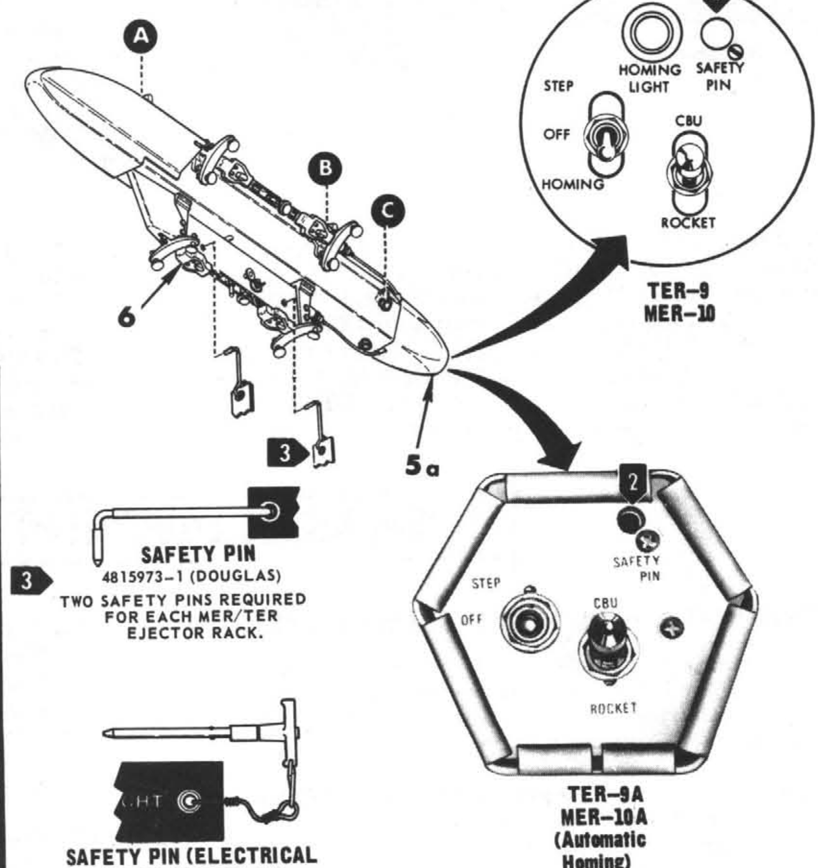


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Figure 1-9 (Sheet 1 of 4)

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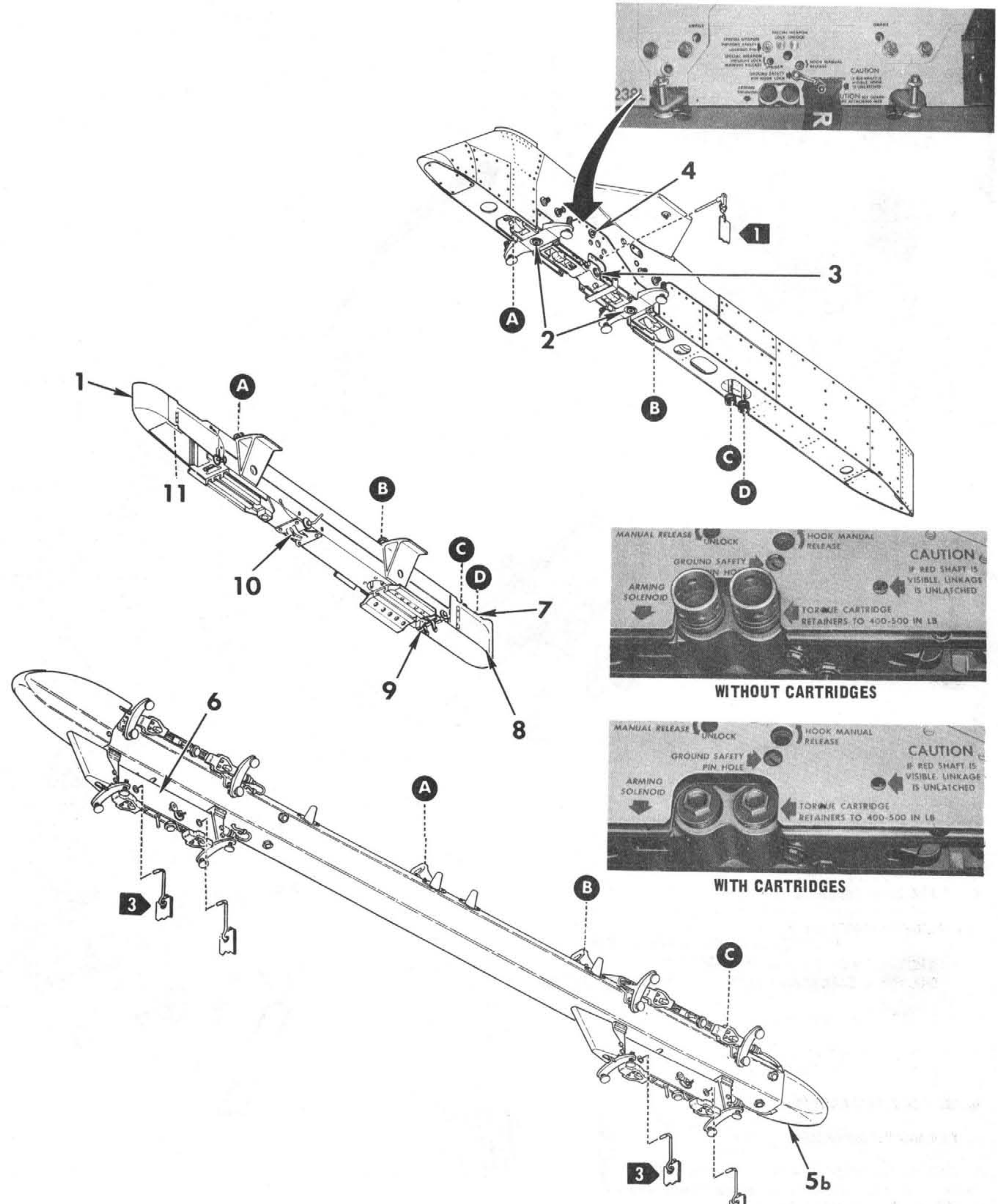
OUTBOARD ARMAMENT PYLON F-4C



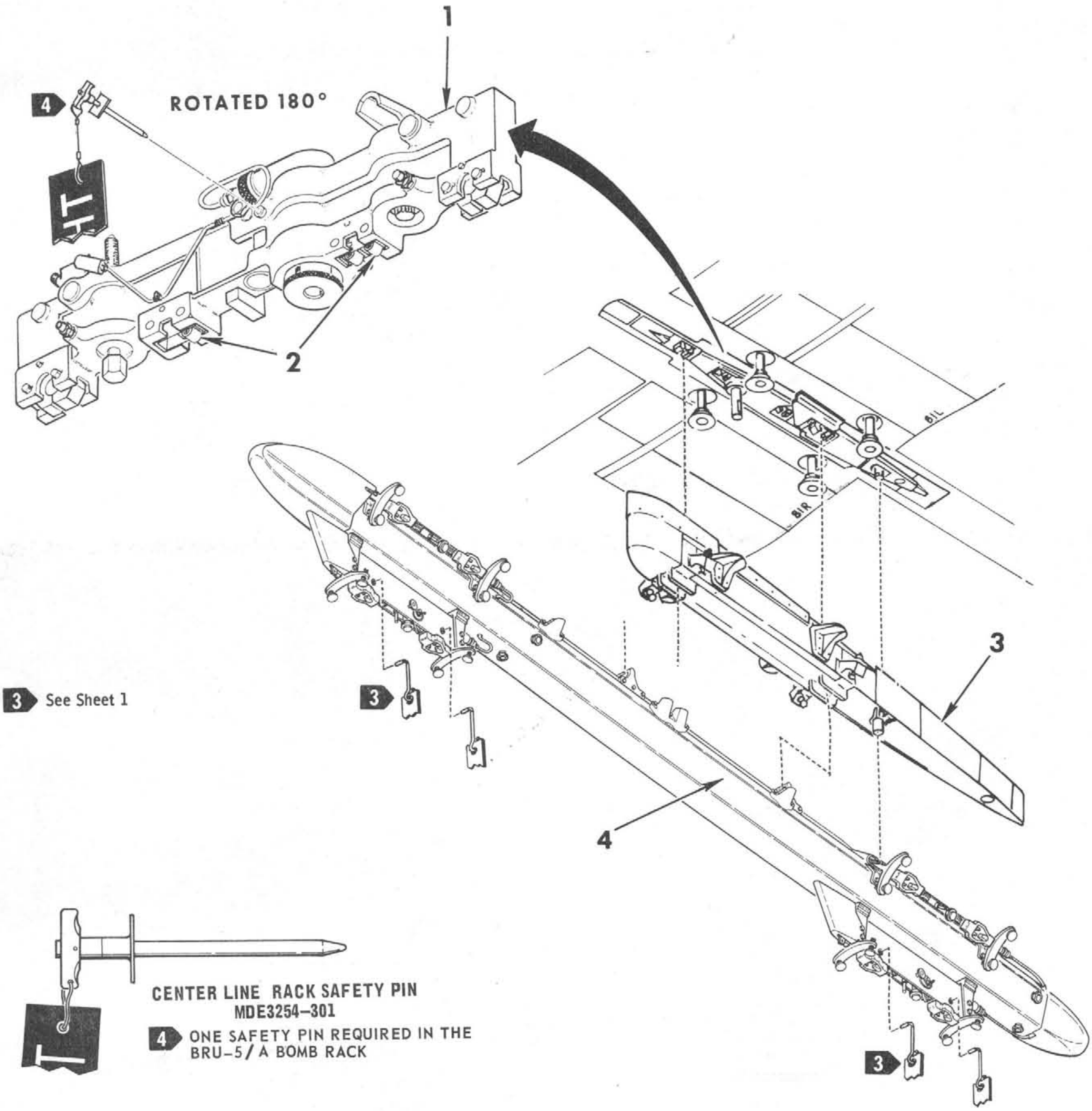
WITHOUT CARTRIDGES

WITH CARTRIDGES

F4C-34-I-123-2

Figure 1-9 (Sheet 2 of 4)

CENTERLINE RACK F-4C



1. CENTERLINE EJECTOR RACK (BRU-5/A)
2. ARMING SOLENOIDS (1 AFT, 2 FWD)
3. CENTERLINE BOMB RACK ADAPTER
4. MULTIPLE EJECTOR RACK ASSEMBLY (MER)

F4C-34-1-123-3

Figure 1-9 (Sheet 3 of 4)

SUSPENSION EQUIPMENT F-4C (CONTINUED)

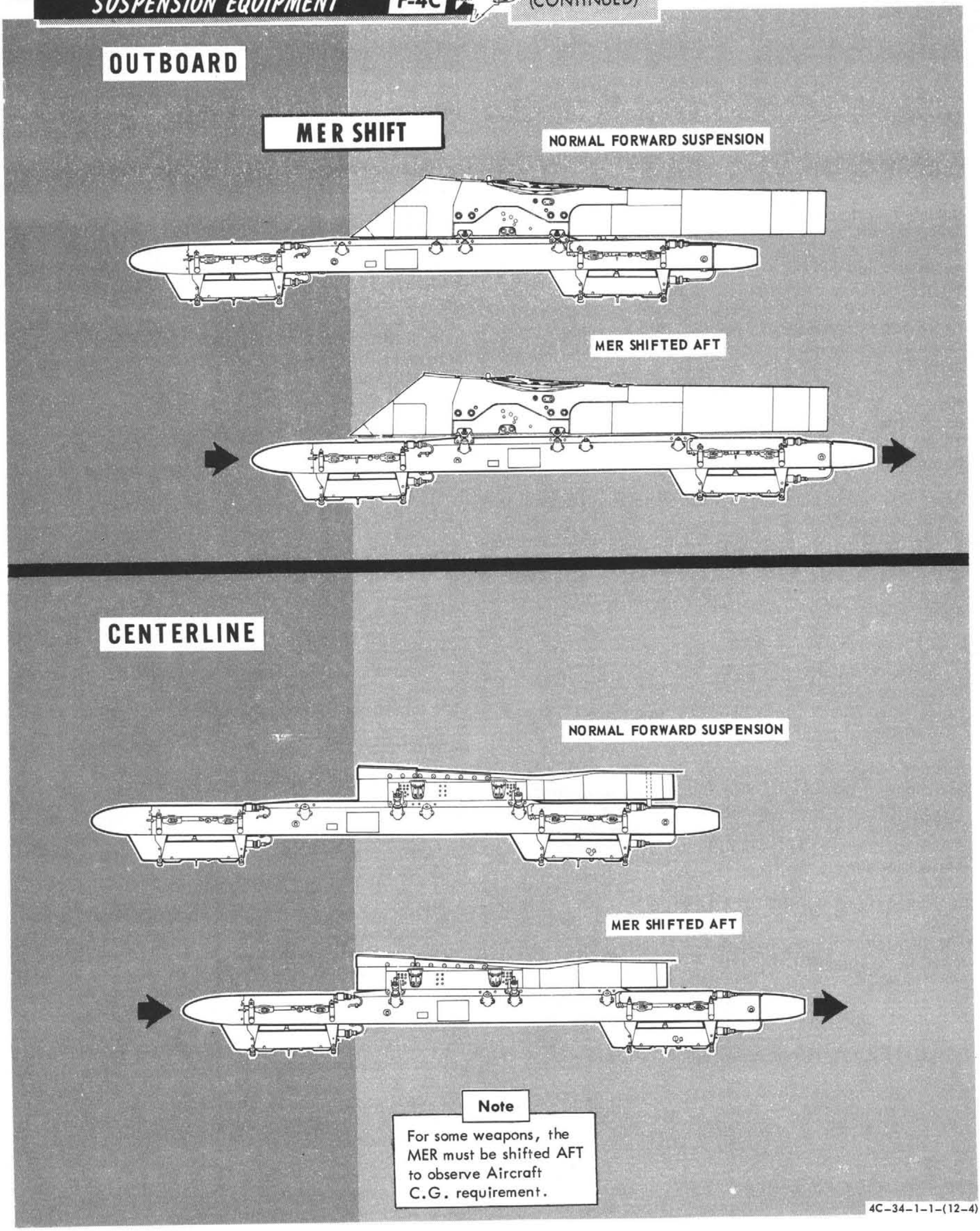


Figure 1-9 (Sheet 4 of 4)

BRU-5/A BOMB RACK (AERO 27/A) BEFORE T.O. 1F-4-750

The BRU-5/A bomb rack (figure 1-9, sheet 3) is a self-contained ejector unit mounted within the aircraft at centerline station 5. The Aero-27/A rack has four suspension hooks: two 14 inches apart and two 30 inches apart. The BRU-5/A rack has only 30-inch hooks and arming solenoids in place of the 14-inch hooks. An ejector piston is in the center of the rack. Operation of the rack hooks and the ejector piston is initiated through the jettison circuit or the nuclear release circuit by igniting two ejector cartridges. Gases from the ejector cartridges cause the rack hooks to open and the ejector piston to push downward on the bomb or suspension equipment. An electrical safe switch is opened, when the bomb rack safety pin is installed, to prevent the cartridges from firing; the pin is removed prior to flight. The MER cannot be suspended from the bomb rack without the centerline bomb rack adapter. The weight of the Aero 27/A bomb rack (51 pounds) is not included in the basic weight of the aircraft and must be included in any gross weight computation. The weight of the BRU-5/A is 45 pounds.

After T.O. 1F-4-750, the two 14-inch suspension hooks are replaced by two arming solenoids. A centerline single bomb shorting plug is installed to permit the release of the MK 84 or M118GP bomb through the conventional release circuit. Illumination of the TK light reveals the installation of the shorting plug.

Note

> Even though the TK light is on, the tank aboard relay is not energized; therefore, the forward AIM-7 missiles can be monitored, launched, and jettisoned.

After the bomb is released, the TK light remains on. The M118 or MK 84 on centerline can be jettisoned with the external stores jettison button, the centerline tank jettison switch, the nuclear store jettison switch, and can be released through the DCU-94/A control monitor.

CENTERLINE BOMB RACK ADAPTER

The centerline bomb rack adapter (figure 1-9, sheet 3) is attached to the centerline position to accept the MER assembly. The adapter is compatible only at the centerline, and attaches directly to the BRU-5/A bomb rack. The adapter weighs 55 pounds.

MAU-12B/A ARMAMENT PYLONS

The inboard and outboard armament pylons (figure 1-9, sheets 1 and 2) are bolted to the wing at stations 1, 2, 8, and 9. The pylons cannot be jettisoned. Each armament pylon assembly includes the MAU-12B/A ejector rack, weapons relay panel, a power rectifier, and bomb release circuits. The ejector rack contains two cartridge breeches and ejector pistons, 14 and 30-inch suspension hooks, three arming wire solenoids, and a solenoid operated assembly that electrically locks (safeties) the cartridge fire circuit. When the cartridges detonate, gas pressure opens the rack hooks and forces the pistons downward, ejecting the bomb. To compensate for various bomb CG locations, orifices are installed into the rack to control bomb separation characteristics by varying the forces delivered to the piston. The ground safety pin when installed - provides only a mechanical lock in the hook linkage for ground safety purposes. The inflight safety lockout solenoid electrically isolates the cartridges by mechanically controlling two switches that break the cartridge circuit. The lock must be removed when the MER or TER is aboard by manually installing the flight safety lockout pin (or bolt) in the pylon. The bolt is installed only for non-nuclear bomb carriage and must be removed for nuclear carriage. When the bolt is installed, the DCU-94/A Unlock light for that station illuminates continuously. The arming wire solenoids are controlled by the position of the arm nose tail switch.

Note

> The MAU-12C/A is completely interchangeable with the MAU-12B/A armament bomb rack. The MAU-12C/A is a strengthened MAU-12B/A.

LAU-34/A LAUNCHER

This assembly must be used to carry and launch the AGM-12B and AGM-45A missiles. The launcher contains the electrical circuits and relays which are responsible for the dispersal of missile pre-heat, pre-arm, and missile launch voltage. The method of carriage is illustrated (figure 1-9). The launcher also contains a cartridge-fired jettison gun assembly. Expanding gas from the detonated cartridges operates the assembly and slides the missile rearward, free of the launcher rails. The missile freefalls in an inert state.

MULTIPLE EJECTOR RACK (MER)

The multiple ejector rack used at the outboard wing stations and the centerline station are the MER-10 and MER-10A. The MER-10A function differs from the MER-10 as follows:

a. Only the loaded MER-10A stations receive a release pulse regardless of the arm nose tail switch position.
b. The MER-10A is automatically homed to the first loaded station in sequence each time power (28vdc ESS BUS) is applied to the aircraft. The MER-10A does not have a homing light.
c. The step switch on the MER-10A is used for ground checkout operation.

The MER has two suspension lugs mounted 30 inches apart. The MER consists of six 14-inch ejector units, 12 arming solenoids, the control unit and wire bundles required to arm, release, and/or fire munitions carried. Each ejector rack or point is identified with a number corresponding to its release sequence. All MERs are rigged 1° nose down for rockets. The centerline MER weight is 215 pounds; the outboard MER weighs 225 pounds.

TRIPLE EJECTOR RACK (TER)

The triple ejector racks used at the inboard wing stations are the TER-9 and TER-9A. The TER-9A function differs from the TER-9 as follows:

a. The TER-9A is automatically homed to the first loaded station in sequence each time power (28vdc ESS BUS) is applied to the aircraft. The TER-9A does not have a homing light.
b. The step switch on the TER-9A is used for ground checkout operation.
c. Only the loaded TER-9A stations receive a release pulse regardless of the arm nose tail switch position.

The TER has two suspension lugs mounted 30 inches apart. It consits of three 14-inch ejector units, six arming solenoids, control unit and wire bundles required to arm, release, and/or fire munitions that are carried. Each ejector rack or point is identified with a number corresponding to its release sequence. TER's are permanently rigged 1° nose down. The TER weighs 95 pounds.

REHOMING MERS AND TERS

A hung bomb can be released, in some cases, after rehoming the MERs and TERs. Rehoming is accomplished in flight by cycling the weapon selector knob from BOMBS to RKTS & DISP and back to BOMBS. This action causes the station stepper switch in all MER/TERs aboard to move from the OFF position to the first loaded station in sequence. The stepper switch will not move if on a loaded station or the MER/TER is empty. (A defective store aboard sensing switch could cause the MER/TER to appear empty.) The MER/TER stepper switch OFF position is obtained only in the BOMBS mode and after a release pulse has been sent to each of the loaded stations on the MER or TER. Additional bomb release pulses will not move the stepper switch from the OFF position. Selecting RKTS & DISP moves the stepper switch from the OFF position because there is no OFF position in the MER/TER with the RKTS & DISP mode. The MER/TER stepper switch always steps to the next loaded station and continues to repeat the cycle when the RKTS & DISP mode is used.

Note

Do not confuse the *rehoming* procedure performed by the aircrew with the *homing* procedure performed by the load crew. The load crew will position the STEP-OFF-HOMING switch on the MER-10 or TER-9 to HOME and obtain a steady green light. (The TER-9A and MER-10A do not have the green homing light nor the homing switch. The rack automatically homes to the first loaded station in sequence each time power, 28vdc Essential Bus, is applied.)

The following causes of bomb release failure can be corrected in flight by rehoming the MER and TER, provided the MER/TER stepper has arrived at the OFF position.

a. Improper homing of the MER or TER on the ground.
b. Moisture in the bomb ejector rack breech that grounds-out the release signal. After the MER and TER are rehomed, succeeding release pulses can (in come cases) generate sufficient heat to evaporate the moisture in the bomb ejector rack breech.

The following causes for failure of the bomb release circuit cannot be corrected inflight by rehoming the MER and TER:

a. Faulty ejector rack cartridges.
b. Broken or shorted wiring to the ejector rack cartridges.
c. Faulty relays.

If all the bombs carried will not release, the ejector racks should be rehomed and release attempted again. Rehome the MER and TER as follows:

a. Weapons selector knob - RKTS & DISP

After the remaining switches are set for bomb release, the bomb release button is depressed and held for 4 seconds with BOMBS/RIPPLE selected. With the MER-10/TER-9, if the weapon will not release when the arm nose tail switch is in an armed position, rehome and then repeat the BOMBS/RIPPLE release procedure with the arm nose tail switch in SAFE. If the station loaded sensor switch is failed in the station empty position, releasing the weapons safe supplies a release pulse to the loaded stations and the unloaded station.

Note

- The arm nose tail switch position does not affect the operation of the TER-9A, MER-10A stepper switch; the release pulse is directed only to the loaded stations.
- If the bombs cannot be released after performing the preceding procedures, it must be assumed that the ejector rack cartridges will not fire, or the MER or TER is malfunctioning.

Consider the situation where three rocket launchers are loaded on a TER. The TER stepper switch has four positions: 1, 2, 3, and OFF. The first loaded point in sequence is referred to as the home position. Assume that the rocket launchers on points one and two have been fired-out and the rocket launcher on point three is full, i.e., no attempt was made to fire the remaining rocket launcher. (The full launcher must be released or fired before the empty launchers can be released.) To release the rocket launcher, the weapon selector knob is positioned to BOMBS. When the bomb release button is depressed, a pulse is supplied to release the full rocket launcher on point No. 3. When the bomb button is released, or the firing pulse is ended, the stepper switch moves to OFF. Succeeding pulses will not move stepper switch from OFF. To release the two remaining empty launchers, the weapons selector knob must be positioned to RKTS & DISP. Power is now supplied to the stepper switch to position it to a loaded point; in this case, point No. 1. The AC can now select BOMBS and release the two empty dispensers.

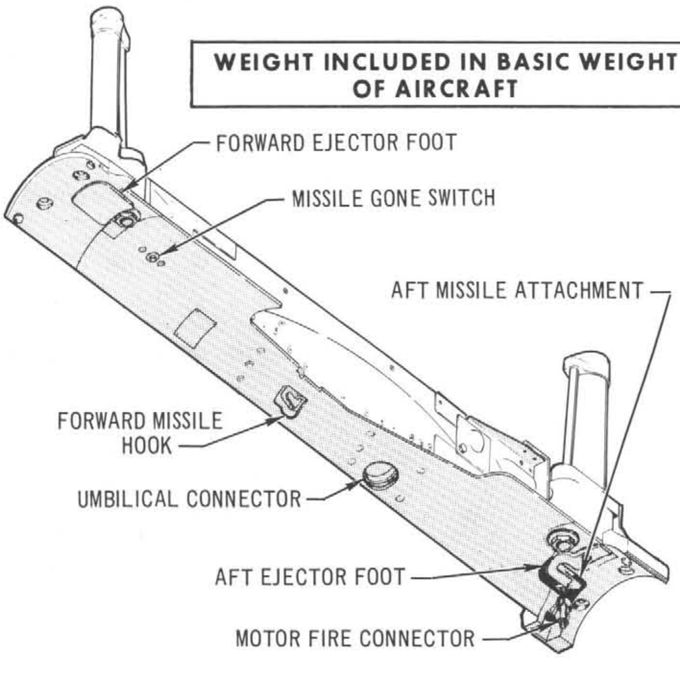
In this example, the rocket pods are released from the TER out of normal bomb release sequence, i.e. TER station 3, 1, 2. The normal bomb release sequence is TER station 1, 2, 3 (refer to figure 1-7).

AERO-7A MISSILE LAUNCHER

F-4C

AIM-7 MISSILE

WEIGHT INCLUDED IN BASIC WEIGHT OF AIRCRAFT



AERO-7A LAUNCHER SAFETY PIN (4)

4C-34-1-1-(13)

Figure 1-10

CAUTION

Rocket pods and CBU dispensers (full and empty) should be released from the MER/TER in the normal bomb release sequence to avoid possible aircraft damage.

There is presently no cockpit indication or procedure to ensure which MER/TER station is selected for BOMBS release after RKTS & DISP has been used. The position of the MER/TER stepper switch is established by the number of dispensing signals to the aircraft station and the number of dispensers (or rocket pods) on that station; i.e., the number of dispensing pickle signals to a loaded station must be equal to the number of dispensers loaded on that station (or a multiple of the number of dispensers on that station) prior to selecting BOMBS to release the dispensers/rocket pods from the MER/TER.

AERO-7A MISSILE LAUNCHER (AIM-7D/E/E-2) MISSILE

Four Aero 7A launchers are mounted in the fuselage so that four AIM-7D/E missiles are semi-submerged. The Aero-7A launcher (figure 1-10) has two ejector pistons which are operated by gas generating cartridges to eject the missile downward approximately 8 inches before the missile motor is fired. Each of the forward fuselage stations has a cavity door that closes after the missile is gone, to smooth the contour of the fuselage. Each launcher is electrically and mechanically protected from inadvertent firing of the ejector cartridges by a safety pin which is removed prior to flight.

LAU-7A/A MISSILE LAUNCHER

Refer to T.O. 1F-4C-34-1-1A.

AGM-12 WEAPON SYSTEM (F-4C)

This section describes the AGM-12B/C/E guided missile launching system and, cockpit controls and controlling procedures. Refer to part 4 of this section for a description of the AGM missiles.

With respect to missile control and flight operations, the missiles are nearly identical. The AGM-12B and 12C missiles are both ground burst devices, with the AGM-12C being considerably greater in weight and explosive yield. The AGM-12E is basically the same as the AGM-12C, except the -12E missile is an air-burst, anti-personnel device.

MISSION DESCRIPTION

The AGM-12 missile and associated equipment provides the radio-controlled guided missile capability to enhance the air-to-ground strike mission. With the AGM-12 system energized, the AC begins an attack (dive or level) on the target and stabilizes the airplane flight path directly toward the target. The AC attempts to maintain a constant line-of-sight (LOS) with the target throughout the missile run. The missile fire signal is delivered by depressing the bomb button (either cockpit), igniting the missile liquid-fuel engine and the tracking flares. After engine burn-out (approximately 2.0 seconds) the AC begins transmitting steering commands to the missile receiver. The system transmitter emits the r-f signals as the control selector handle is positioned in combinations of left-right or up-down movements. Hence, the AC directs the missile flight path in azimuth and elevation, causing the missile (visible tracking flares) to close on the LOS to the target.

CONFIGURATION AND SUSPENSION

AGM-12B MISSILE

Four AGM-12B missiles, one on each wing station may be carried and launched against ground targets. The suspension system is shown in figure 1-9. The LAU-34/A launcher is loaded directly on the armament pylon bomb rack. The branched wire bundle from the armament pylon is attached to both receptacles on the aft end of the launcher. The forward branch powers AGM-12B functions; the aft branch powers AGM-45 missile functions which are discussed later in this section. In a jettison situation, only the missile is jettisoned; the launcher remains on the aircraft.

AGM-12C AND -12E MISSILES

A total of two AGM-12C and -12E missiles may be carried, one on each inboard station. An AGM-12 relay panel, installed only in the inboard armament pylon, relays the pre-arm and missile fire/release signals from the cockpit. Hence, the missile is loaded directly on the pylon (MAU-12B/A) bomb rack. In this case, the fire signal ejects the missile from the rack and the missile engine ignites immediately after ejection. A discussion of AGM-12C/E missile fire and jettison procedures is provided later in this section.

LAU-34/A LAUNCHER (AGM-12B CARRIAGE)

The launcher (figure 1-9) is responsible for the proper dispersal of pre-heat, pre-arm, and missile fire voltage. When the aircraft main bus system is energized, power is automatically directed to missile components for warm-up purposes and the system transmitter receives standby power. Thus, the system is in a warm-up condition as soon as the main bus system is energized.

When the AC selects the AGM-12 missile on the weapon selector switch, relays in the launcher are energized that unlock the pre-arm and missile fire circuit. As the AC depresses (and holds) the bomb button, the missile battery, gyro, pneumatic control system, and warhead arming circuits are activated. The missile battery builds up to power and closes a relay in the launcher – completing the circuit between the bomb button (depressed) and the liquid engine ignitor. The firing sequence takes approximately 2 seconds. The engine thrust force breaks the shear pin in the forward retention mechanism and the missile is free to launch. As the missile separates from the aircraft, the umbilical breakaway connector separates and the missile systems function on battery power.

If the AGM-12B must be jettisoned, the jettison signal energizes a cartridge in the launcher jettison gun assembly. The force of the expanding gas from the cartridge rotates the aft retention mechanism and slides the missile rearward, free of the launcher rail. In this case, the missile freefalls in an inert state. Only under the condition of a normal, powered launch will the warhead become armed.

CONTROL HANDLE vs. CANARD DEFLECTION F-4C

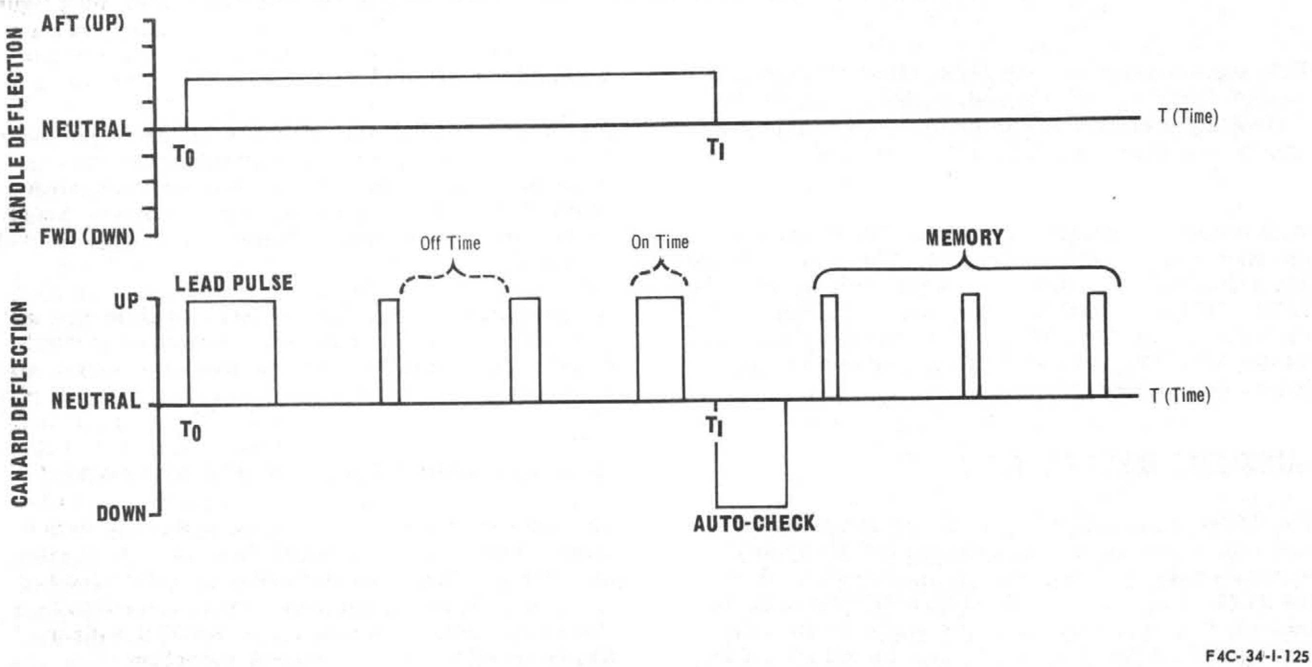


Figure 1-11

AIRCRAFT COMPONENTS

TRANSMITTER AND CONTROL SELECTOR (AN/ARW-77)

With the aircraft bus system energized, 28 volt dc power is continually applied to the transmitter electron tube filaments, crystal heaters, and voltage regulator. When bomb button voltage is applied at launch, the ARW-77 transmitter signal is initiated and an internal timer (in the transmitter) begins a 50 ± 10 second cycle. The timer sustains transmitter output for the above time period after the AC releases the bomb button. The output signals from the cockpit control selector are converted into command pulses by the transmitter. The transmitter circuits code, amplify, and apply the commands to the lower UHF antenna. Any one of the 24 command channels may be used, depending upon the crystal installed in the transmitter. The transmitter crystal assembly installed must match that of the missile receiver.

The control selector (figure 1-12) receives power directly from the transmitter and in turn applies command output voltages to the transmitter circuit. With the control handle in the neutral position, the system continually emits a neutral or reference signal. Movement of the handle causes signal changes with respect to the reference signal. The amount of change is directly proportional to handle displacement. A further discussion of control handle functions in the command link system is provided in later paragraphs. Transmitter output to the missile is always emitted through the lower UHF antenna on the nose gear door. Any UHF radio transmission, while the AN/ARW-77 transmitter is in operation, is automatically emitted through the upper UHF antenna, regardless of the antenna switch position (UPR or LWR).

MISSILE CONTROL

ADAPTIVE CONTROL SYSTEM

The features of the adaptive control system may be described by observing the functions of an individual command. These functions (listed below) are directly controlled by AC manipulation of the control handle in the cockpit:

a. Lead Pulse.
b. Variable Pulse Rate Frequency.
c. Auto-Check Command.
d. Memory Command.

When the AC deflects the control handle providing an input voltage to the transmitter, circuits in the transmitter develop command pulses by repeatedly conduct-

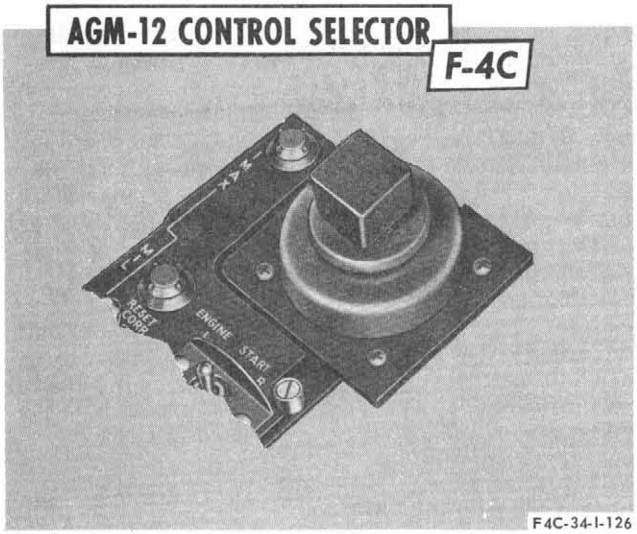


Figure 1-12

ing and deenergizing, applying and removing voltage for transmitter pulse output. The net result is that the missile canards momentarily deflect and then return to neutral as each pulse is applied, continuing the pulsating deflections as long as the handle is displaced. The canards always deflect fully with each pulse, regardless of the degree of control handle displacement. As an example, assume that the AC — having launched a missile — applies an up correction by moving the handle aft. Further, assume that the stick is deflected about one-half travel at time T_0, and then returned to neutral at time T_1 (figure 1-11). In the figure, off time refers to the time between pulses when the canards are neutral: on time refers to pulse duration, which corresponds to canard deflection time.

Since an up correction is necessary, the missile is low with respect to the LOS and probably going lower due to the effect of gravity. (Also, note that the AGM-12C missile is ejected and not launched, which applies another force component to the missile normal to the LOS.) Hence, as the AC moves the stick, the command must initially apply enough energy to rotate the missile axis and change its course, and in some measure account for the time lag in the command link system. The lead pulse, that functions to quicken missile response for the above reasons, is applied for a longer period than subsequent pulses as figure 1-11 indicates. The width, or on time, of the lead pulse is proportional to how rapidly the AC moves (or accelerates) the stick to the desired position. A rapid movement delivers a lead pulse of greater duration than that of a gradual movement. This is in keeping with the natural tendency to correct rapidly if the AC notices a large error developing. Conversely, the lead pulse function points out the necessity of using gradual, smooth, control stick movements in instances where missile steering is extremely sensitive or where steering errors are small.

As long as the control handle is held in the deflected position, the pulse train continues. After the lead pulse, subsequent pulses are short at first, increasing in duration (time) as the stick is held. This means that the canards are deflected for increasing periods of time with each pulse. If the AC increases the amount of handle deflection, the amount of pulses per unit of time increases, or in other words, the frequency increases. Hence, the pulse rate frequency varies proportionally with the amount of handle displacement. If the handle is displaced to full travel, the pulse is continuous and canard deflection is continuous. This is the same as stating (regarding figure 1-11) that off time decreases and on time increases as handle displacement increases. The idea is that the AC deflects the handle a specific amount for an observed error. Then as the missile is observed to correct toward LOS at a satisfactory rate, handle deflection may be reduced so that the amount of error and command pulses delivered approach a condition of balance. Small random errors are then corrected by slight, smooth handle movement about the neutral position.

As the handle is returned to neutral at time T_1, the automatic check command is delivered. The check pulse performs very nearly the same function as the lead pulse, but the situation is reversed. As the missile corrects and approaches the LOS, a force must be applied to rotate and align the missile axis with the LOS - preventing overshoot. Just as the lead pulse, the pulse duration of the check command is proportional to the rate of handle movement to neutral. If the AC notices an overly rapid rate of closure with the LOS, he would naturally return the handle to neutral at a rapid rate. Thus, the AC is able to reduce lateral or vertical acceleration without handle deflection in the opposite direction.

After control handle voltage is removed, the system automatically generates small memory commands at a constant rate. These commands will continue throughout missile flight time unless they are countered by stick movement in the opposite direction. The frequency of the memory commands is a function of the amount and duration of the initial handle displacement. A small handle deflection held for a long duration can develop the same memory as a large handle deflection held for a short duration. The memory circuits function to aid in overcoming natural forces continually acting on the missile. In the example command cited here, the up memory would serve to compensate for further gravity drop.

In view of the above, one can visualize the system when handle movements are made in directions other than the cardinal ones. If the handle is moved to deliver an up-right command for example, the command sequence in figure 1-11 is applied in both up and right directions simultaneously. The point to be made is that the AC need not restrict control movement to cardinal directions only, but may use combinations of the cardinal commands and vary their magnitude.

CONTROL CONSIDERATIONS

The above discussion treats the system somewhat ideally for purposes of demonstration. In practice, there are several more things to consider. The AC

must establish the desired LOS with the wings level, applying enough forward trim to counteract the tendency for the nose of the aircraft to rotate as velocity during the dive increases. Remember that the missile gyro is uncaged while the missile is still on the launcher, and that the gyro establishes a vertical reference relative to the position of the aircraft. Thus, if the aircraft is in a 45° left bank at launch and subsequently rolled level after launch, an up-command will result in the missile steering up-left.

When firing the liquid engine, the missile will be plainly visible at launch. Engine burnout is identified by a puff of white smoke. The AC must ensure no commands are issued until after engine burnout. The AC will obtain best results if he can avoid the natural tendency to fix his vision on the missile flares after launch. Rather, keep the eyes fixed on the target (or impact point on the target) and view the missile flares through the peripheral vision. The picture is similar to the pipper light floating on the wind screen. This procedure will help maintain a steady LOS.

In most cases, the missile appears below the target and to the left or right, depending upon the wing station used. If the missile is low, the first feasible command is the up command to initiate the upward correction, and to help counteract further sink due to gravity by establishing up memory. At the lower release angles, the effect of gravity will be greater. If the missile is initially high before any commands are issued, allow gravity to correct the elevation error. A down command with down memory, plus the effect of gravity, is sure to result in overshoot below the LOS. With all systems functioning normally, the command link system is most sensitive during the first few seconds after engine burnout. Hence, use smooth control action to establish a desirable corrective *trend* toward LOS, rather than attempting to eliminate all sources of error immediately. Missile steering tendencies will vary; that is, some missiles will be more sensitive than others. When applying the initial command, however, all missiles should be regarded as *very* sensitive; it is easier to add more handle displacement than to correct an over-controlled missile.

The AC can get an idea of how much handle deflection is needed by observing missile trend. To illustrate, suppose the flares are observed to move from left to right toward the LOS at a rapid rate. At the instant the flares move into and coincide with the LOS, the apparent error is zero; but the error trend remains very large since the angle between the missile axis (or flight path) and the LOS is relatively large. In this case, considerable control movement, with proper lead, would be necessary to avoid overshoot. However, if the missile is considerably wide but generally holding position relative to the LOS, the missile axis may be considered to be nearly parallel to the LOS. In this case, a lesser control deflection is necessary to divert the missile and the AC uses smooth control input, varying handle deflection only to establish a controllable correction rate.

If the missile can be established at a point close (and parallel) to the LOS early in flight, there should never be any need for large, rapid, control handle movements. In fact, during the early phase of missile flight, the AC will usually have to use conscious effort to avoid overcontrol. With the adaptive system, a small degree of handle displacement held for a longer time produces the same effect as a full deflection for a very short interval. The former is by far the more desirable, however, since the trend of missile correction is more easily judged. The continuing effect of gravity must be kept in mind, and possibly used to an advantage. As dive angle increases, that component of gravity that tends to pull the missile down from the LOS becomes less. However, if the missile steers slightly high, up memory will probably not be sufficient to continually hold the missile high and gravity may be used to make the necessary correction. The AC must avoid anticipating the impact, and continually fly the missile until impact is observed.

Roll Reference Shift

The description of the AGM-12 gyro system (part 4) points out that at supersonic velocity, the missile roll rate is an average 500° per second. Further, the pickoff brushes in the missile gyro are biased 50° to compensate for 0.1 second time lag in the command link system. As the missile decelerates, however, and approaches the transonic region (Mach 1.1 to 0.9), the lift force at the bent wing tips increases rapidly and causes a rapid increase in roll rate. Missile roll can increase to an approximate maximum rate of 1000° per second. Thus, maximum shift becomes approximately 100°, which means that the original 50° bias no longer compensates for the command lag and missile response would occur 50° counterclockwise from the desired response. It is difficult to predict the point at which roll reference shift begins since one must consider factors such as launch angle, launch velocity, and individual control technique which directly effects the rate of missile deceleration. If the technique of steering the missile along the LOS is executed properly, the buildup rate of roll reference is very slow and actual observance of the shift phenomenon is impossible.

A rule-of-thumb method has been devised that — knowing a desired time of flight (T_f) — may be used to determine launch altitude (AGL) for a specific dive angle. The method makes use of a factor which corresponds to a specific T_f as follows:

Factor	T_f
0.3	10 sec.
0.4	15 sec.
0.5	20 sec.
0.6	25 sec.
0.7	30 sec.

For example, assume the AC begins the dive on target, establishes LOS, and observes the dive angle to be 35°. If the 20 sec. T_f is planned, the factor of 0.5 is applied (above) so that launch altitude (AGL) is:

0.5 x 35° dive = 17.5 thousand feet AGL.

If target altitude is 1500 feet MSL, indicated launch altitude becomes:

17.5 +1.5 = 19.0 thousand feet.

The above method is accurate within ± 2 seconds for dive angles within 15° and 45°, and launch airspeeds between 300 and 600 KTAS.

Offset Deliveries

All previous considerations stated apply to offset deliveries. In this delivery, the LOS continually rotates. For example, if the target is approximately 10° right at launch, it may move to a relative position of 40° right at impact. In view of the shift phenomenon discussed above, the target must always be offset to the right. In a shift environment, a right command would result in an up-right response, a relatively easy situation to control. A left command, however, would result in a down-left response, which is nearly impossible to control in an offset mode. In any delivery situation, the rate of LOS rotation can be reduced by reducing airspeed to as low a rate as the situation permits.

COCKPIT CONTROLS

As mentioned previously, AGM-12 selection and fire procedures are nearly identical. The AGM-12C and -12E missiles may be carried only on the armament pylon (inboard station). The AGM-12B may be launched from either pylon configuration since the LAU-34/A launcher must be used. Hence, in these aircraft, the same switches are used to select and fire either missile. It is only necessary to point out minor differences in the firing sequence for the missiles.

AGM-12 SELECTION

Since power is immediately available to warmup system components, there is no need to position switches for this purpose. With the main bus system energized, power is available for missile components requiring preheat and for the system transmitter in the aircraft. The AC arms the AGM-12 firing system by positioning switches on the multiple weapons control panel (figure 1-6).

Weapon Selector Knob

AGM-12B. With the weapon selector (WPN SEL) knob positioned to GAM-83 (AGM-12), the AC arms the following circuits: (1) Two launcher relays are energized: one closes the circuit which allows bomb button voltage to activate the missile thermal battery and arming circuits at fire time. The other closes an interlock in the bomb button/missile igniter circuit. (2) The selection also energizes the GAM-83 relay, which will direct bomb button power (through the Gam - Aux switch) to activate the transmitter timer. The bomb button signal actually energizes a timer in the transmitter, which sustains transmitter output for 50 ± 10 seconds. The functions of condition (1) above cannot go further until the AC energizes the switches discussed below.

WARNING

Only the GAM-83 position may be selected to launch the AGM-12 missile. However, this position also energizes the release circuit and release whatever bomb might be loaded on a selected ordinance station MER or TER. Hence, selecting GAM-83 — with loaded MER or TER equipment aboard — is the same as selecting BOMBS SINGLE.

AGM-12C/E. The same functions, as stated above, also apply to the AGM-12C and -12E missiles. The only difference is that the weapon selector switch closes circuits (comparable to statement 1 above) in the AGM-12C relay panel in the inboard armament pylon.

Master Arm Switch

The master arm switch unlocks the non-nuclear weapons release circuit and powers the station selector knob. The ARM position energizes the bomb button transfer relay, which must be energized to fire the AGM-12 missile. Power for the transfer relay passes through contacts of the special weapons relays, which means that the special weapon release circuit must be deenergized to fire non-nuclear weapons. This condition is satisfied if any of the following controls are OFF; the DCU-94/A master release lock switch, the nuclear consent switch, or the five station selector switches. The SAFE position of the master arm switch deenergizes the bomb button circuit and drops power from the station selector knob.

With the transfer relay energized, depressing either bomb button directs voltage to the intervalometer. The intervalometer returns a single firing pulse - alternately to the left or right missile station. The firing pulse passes through the inboard or outboard launcher relays, which are controlled by the station select knob.

Station Selector Knob

With the master arm switch in ARM, 28 volt dc power is available for the station selector. Selecting the INBD or OUTBD WING positions closes the inboard or outboard station relays, respectively. The relays, which form the last interlock in the missile-fire circuit, must be closed to get each fire pulse from the intervalometer to the missile station. With the AGM-12C aboard, only the INBD position would apply.

Intervalometer Step Switch

The step switch is used to electrically reset the intervalometer. Operating power for the intervalometer flows through the NORM position of the switch. Selecting the RESET position drops power from the intervalometer, causing the reset condition. This assures that the next (or first) missile-fire pulse is applied to the left select wing station. The step switch is spring-loaded to NORM.

Note

Removing power from the intervalometer by any manner, such as engine shut-down will establish the reset condition.

The AC will usually fire left wing armament first. As an example, suppose all four wing stations are loaded and that the position of the fire (or release) pulse is unknown. Further, suppose that one of the *right* wing stations is to be fired first. Then proceed as follows:

1. Momentarily select RESET to get the launch pulse to the left wing.
2. Place the master arm switch to ARM.
3. Place the weapon selector to BOMBS SINGLE. (This will prevent ARW-77 timer operation during step 5. The same thing can be accomplished by holding the GAM-AUX switch to INTERRUPT during step 5).
4. Check that the station selector switch is OFF, or else left wing armament will fire during the next step.
5. Momentarily depress the bomb button; the intervalometer circuits will position so that the next launch pulse will be directed to the right selected station.

Now the AC selects a specific station (INBD or OUTBD) to launch the AGM-12. If, during the above procedure (step 5), the weapon selector is positioned to GAM-83 (AGM-12), the transmitter timer will energize for 50 ± 10 sec. This is of no consequence if the AC accomplishes the above procedure at least 2 minutes prior to the actual launch; the timer will run out and reset to a standby condition. However, if the AC inadvertently energizes the ARW-77 timer, and must launch the missile immediately, he may reset the timer by momentarily positioning the Gam-Aux switch to INTERRUPT prior to launch. The INTERRUPT position should be held at least a second or so to get a full (50 sec.) reset condition. The AC must note that when the transmitter timer is reset in this manner, the timer will not reset to a standby condition. That is, when the INTERRUPT position is released, the timer will begin again. One must allow the timer to run out completely in order to get a timer-standby condition. Hence, the net consequence of not observing the above procedure is simply that the ARW-77 timer may be partially run out at launch, with the possibility that missile control may be lost before impact.

Gam-Aux Switch

The functions of the Gam-Aux switch are generally presented above. With power on the aircraft, 28 volt dc standby power flows through the NORM position to the transmitter. Momentarily selecting TEST energizes the transmitter timer and initiates the r-f signal output. The signal continues for approximately 50 seconds. The INTERRUPT position, which removes operating power from the transmitter, may be used to guard against transmitting when the missile-fire (bomb button) circuit is activated for any reason other than missile firing. Also, the INTERRUPT position will reset a partially expired timer as stated immediately above. The AC might use the test function in instances where a fly-by command link check is desired with test equipment located on the ground. The switch is spring-loaded to NORM.

Note

In some aircraft, the Gam-Aux switch may not be spring-loaded. The AC must ensure the switch is in the NORM position during and after missile launch.

The Gam-Aux switch performs an additional function for the AGM-12E missile. The INTERRUPT position activates the Good Guidance Monitor (GGM) network, a safety device in the missile fuzing system. (The GGM function is described in T.O. 1F-4C-34-1-1A.) To activate the GGM function during missile flight, the INTERRUPT position must be held for at least 4 seconds.

Bomb Button

Power is available for the bomb button when the landing gear handle is placed in the UP position. With the system switches positioned as specified above, depressing the bomb button starts the transmitter timer and activates the thermal battery in the missile. The bomb button must be held depressed until the missile fires (approximately 2 seconds). The noise of engine ignition, and possible airframe reactions at launch, are plainly discernible to the aircrew.

AGM-12B. The bomb button signal initiates missile thermal battery power, uncages the missile gyro, and charges the pneumatic control system. As the battery becomes active, battery power closes a relay in the LAU-34/A launcher that completes the bomb button/engine ignitor circuit, igniting the liquid engine. The entire sequence takes about 2 seconds.

AGM-12C/E. The functions stated above also occur with the AGM-12C/E aboard. In this case, however, the activated battery completes the bomb button/ejector rack cartridge circuit and the missile is ejected. Tension on the safety switch lanyard closes the engine battery/igniter circuit and the engine ignites.

WARNING

In firing the AGM-12 missile, tests have shown that certain quantities of missile exhaust gas will enter into the cockpit area. Since this gas is *extremely* lethal, the aircrew must ensure oxygen equipment fits properly, and that missile firing operations are conducted using 100% oxygen (both cockpits) until the cockpit atmosphere can be completely changed.

Note

Refer to part 4 of this section for a description of the AGM missiles.

PART 2 DESCRIPTION F-4D

TABLE OF CONTENTS

MISSION DESCRIPTION (F-4D)

DIVE BOMBING

Dive bombing with the F-4D aircraft can be performed with the aid of the weapons release computer set, (WRCS), or by the DIRECT release mode without the aid of the WRCS. The WRCS delivery mode normally associated with the dive bombing mission is the DIVE TOSS bombing mode (figure 1-13). When the DIVE TOSS bombing mode is used, the weapons release computer solves the bomb ballistics problem for various release speeds, altitudes, and dive angles and automatically releases the bomb. Therefore, mission planning is reduced to obtaining the drag coefficient of the bomb and determining a safe recovery altitude. Wind correction for the low drag bombs is normally not required. Refer to wind correction.

Note

- Neutral rudder trim should be accomplished at the planned delivery speed. Since the turn and slip indicator in the rear cockpit is more sensitive, the pilot should assist the AC by calling the indicator display.
- The bombing tables in T.O. 1F-4C-34-1-2 assume normal G loading for the given dive angle which can be obtained only when a wings-level, straight line flight path is maintained prior to release. The pipper should be allowed to walk toward the target or aimpoint and should arrive when the aircraft is at the release altitude and airspeed. The roll tabs on the optical sight should be used to maintain wings-level flight. If radar lockon can be obtained, the range bar may be used to establish the slant range.

DIRECT BOMB MODE

Several factors must be considered when determining an indicated release altitude: altimeter position error, altitude loss during pullout, minimum aircraft ground clearance; altimeter lag; and target elevation. The altimeter is set according to target pressure reduced to sea level (target altimeter setting). Immediately following bomb release, a 4 G pullout is initiated. The acceleration rate is 4 G obtained 2 seconds after release. If buffeting is encountered, the buffet boundary is maintained until the desired climb attitude is obtained. When the DIRECT delivery mode (figure 1-13) is used, mission planning becomes more detailed. The dive bombing tables provide trajectory data for the various parameters associated with the delivery. Consistency in the all-important roll-in parameter cannot be overemphasized. The parameters of altitude, airspeed, distance from target, and power setting are preplanned to place the aircraft at a predetermined release altitude and distance from target, with a predetermined bomb release velocity and attitude to effect an accurate hit. Because of the longer periods of wind effect on the trajectory of the bomb, it is also important that the aircrew have knowledge of the magnitude of wind effect and, primarily, the wind velocity at release altitude.

Selecting the direct delivery mode enables the lead computing optical sight to be used as a fixed sight reference that can be depressed from zero mils to 245 mils below the fuselage reference line. The actual sight setting is obtained by adding the F-4D aircraft zero sightline angle of attack to the value obtained in the bombing tables (T.O. 1F-4C-34-1-2). The optical sight is used in conjunction with the altimeter, and the calibrated airspeed indicator to determine the release point.

ROCKET LAUNCH

The DIRECT delivery mode is used to fire the 2.75 inch folding fin aircraft rocket (FFAR). The optical sight is operated in the A/G mode. The sight depression angles are presented in the rocket launch tables as a function of angle of attack (gross weight) rather than the depression angle from flight path. Only the RKTS & DISP SINGLE position should be used when firing the rocket launchers to ensure complete fire-out of all rockets.

Note

If RKTS & DISP RIPPLE is selected, the launcher will not fire-out completely because the firing pulse directed from the aircraft intervalometer is not of sufficient length to fire-out the launcher intervalometer.

Fuze arming is not a consideration for rocket launch except when using the WDU-4/A Flechette Warhead, refer to the confidential supplement for release considerations, section V. Safe escape considerations are somewhat different in that the aircraft is flying toward the frag envelope and possible secondary explosions from the target. The safe escape tables in section VI do not consider terrain avoidance nor secondary target explosions. The effect of wind is less than for bombs because of the shorter time of flight. The rocket launch tables presented in T.O. 1F-4C-34-1-2 are valid for all rocket launchers and type of suspension equipment used. Separate launch tables are required for the various categories of warhead used with the 2.75-inch rocket motor.

GUN FIRING

When firing the SUU-16/A gun pod in the air-to-ground mode, either the OFF or DIRECT position should be selected on the delivery mode selector panel to orient the optical sight with the fuselage reference line: refer to optical sight functions (figure

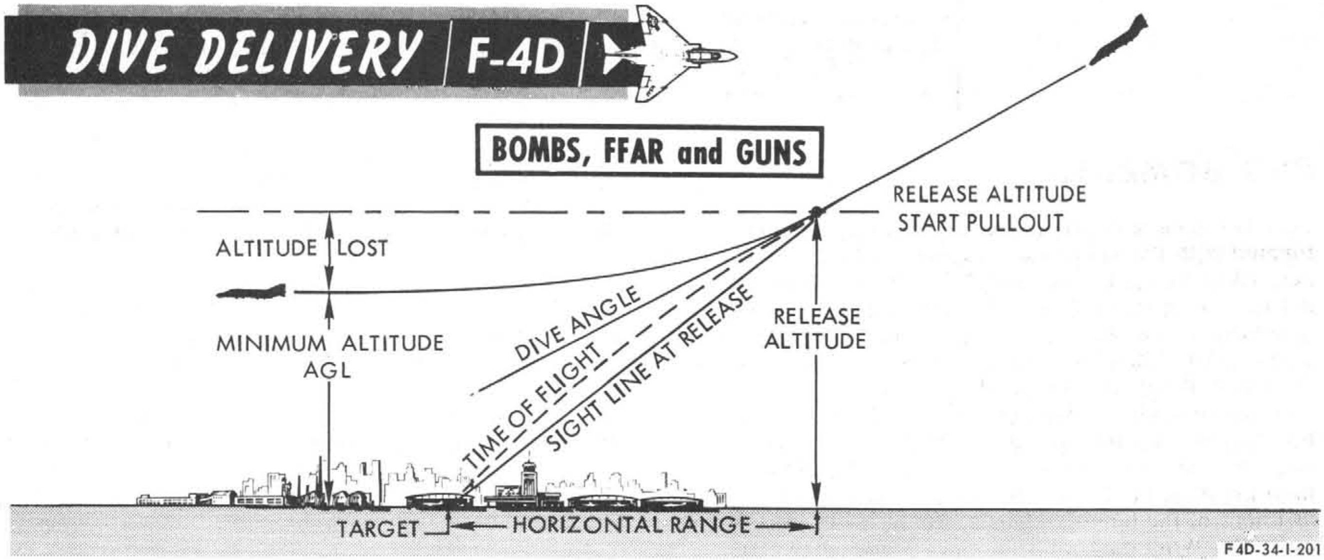


Figure 1-13

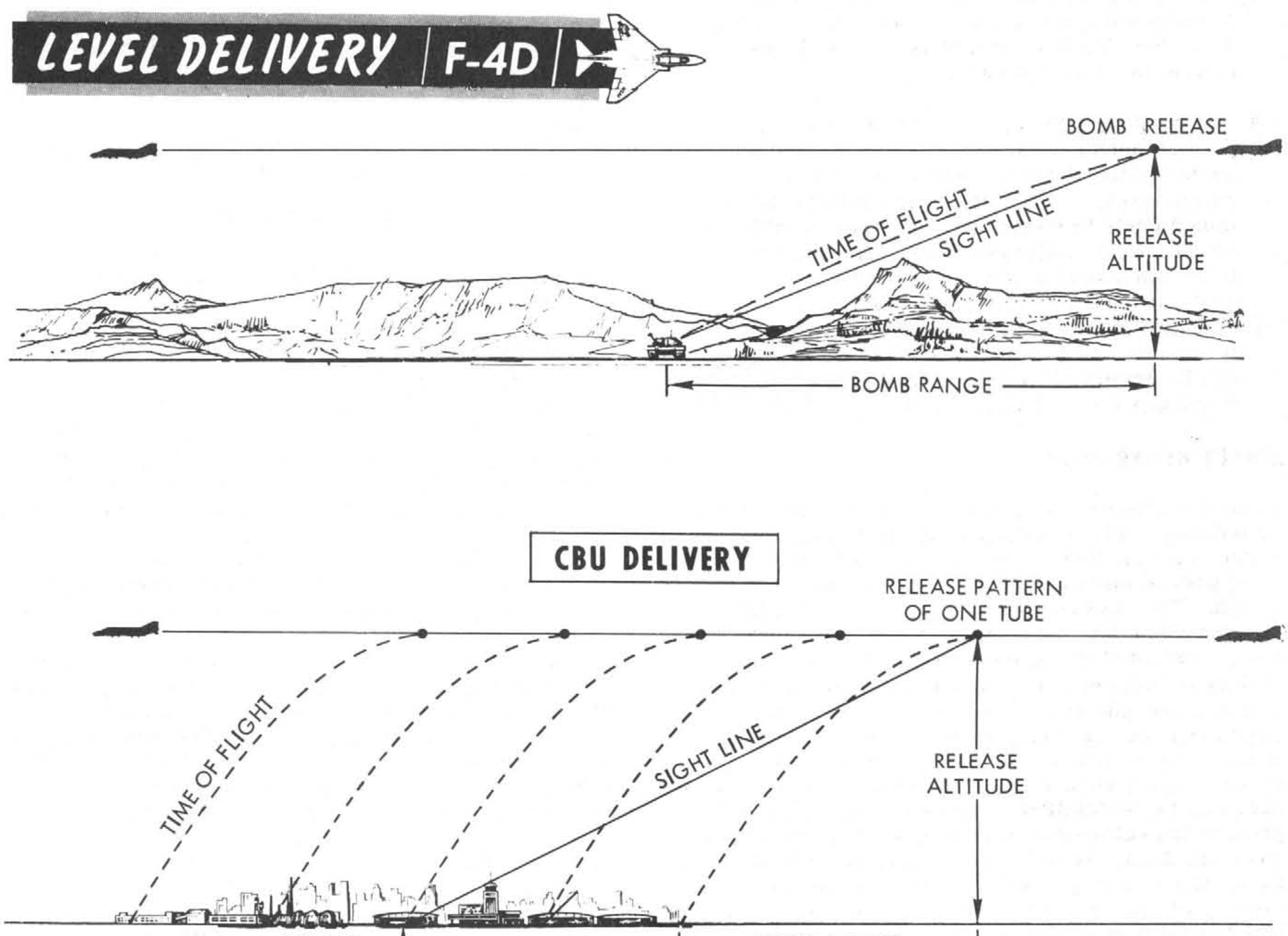


Figure 1-14

1-23). Safe escape considerations when firing the 20mm gun must include terrain avoidance, ricochet, and secondary target explosions. The delivery considerations for firing upon a ground target are generally the same as for bombing and rocket firing. Wind correction and sight depression will be less because of the projectile shorter time of flight. Like the rocket launch tables, the sight setting is given as a function of gross weight. Refer to the description of the SUU-16/A gun pod and the 20mm ammunition. When firing the guns in air-to-air gunnery, the lead computing optical sight set (AN/ASG-22) functions to position the sight reticle in azimuth and elevation and satisfy the geometry of a lead pursuit course: (refer to Air-to-Air Gunnery, this section).

LEVEL BOMBING

Level bombing (figure 1-14) is a special case of dive bombing where the dive angle is zero; the delivery parameters are basically the same. The approach to the target is performed at a constant altitude, wings level, and at a stabilized airspeed. After bomb release, the aircraft may continue the approach course and speed or perform the required escape maneuver. Refer to Safe Escape, section V. The weapons release computer set (WRCS) provides a variety of delivery modes that can be used for level bombing; dive toss (dive-level maneuver), dive laydown, laydown, or offset bombing. Refer to Weapon Delivery Modes (F-4D), this section. The most sensitive parameters that affect bombing accuracy are the release altitude above target and pitch attitude. Refer to Altimeter Position Error Correction, section V. The method used to correct for wind effects is determined by the method of target tracking (crabbed or drifting) and the type of weapon (high drag or low drag). Refer to Wind Correction, section V.

RIPPLE RELEASE BOMBING

Ripple release bombing tables are provided in T.O. 1F-4C-34-1-2. Ripple release (figure 1-15) (dive or level) delivery is identical to the single release with the following additions:

a. Safe escape and dive recovery must be based on the release altitude of the last bomb.
b. The sight setting or bomb range is computed to place the center of the impact pattern on target.
c. Wind correction is based on the time-of-fall of the first bomb released.
d. The minimum release altitude for a level ripple release is based on a straight ahead escape.
e. During the ripple release, a straight line flight path must be maintained. The pipper will pass beyond the target during the ripple release. (The first bomb is released when the pipper is on target.)

When bombs are ripple released (BOMBS RIPPLE or BOMBS TRIPLE) the release advance control can be used with the WRCS delivery modes to place the center bomb on target. The release parameters are computed for a single bomb release.

LOW DRAG BOMB DELIVERY

Level bombing tables are provided in T.O. 1F-4C-34-1-2. Lower release altitudes can be used (i.e., 500 feet) if full military power is selected and a 4.0 G pullup is initiated immediately after bomb release to attain a 20° to 30° climbing attitude. Refer to Safe Escape, section V. Crosswind correction is not required if the aircraft is crabbed to maintain a ground track through the target. Rangewind correction is not required if the bomb is released at a ground speed that is equal to the preplanned true airspeed. Refer to Wind Correction, section V.

Dive bombing tables are provided in T.O. 1F-4C-34-1-2 for all the low drag bombs and the practice bombs. Refer to Safe Escape, the Fuze Arming charts, and Dive Recovery chart to determine the minimum release altitudes.

FIRE BOMB DELIVERY

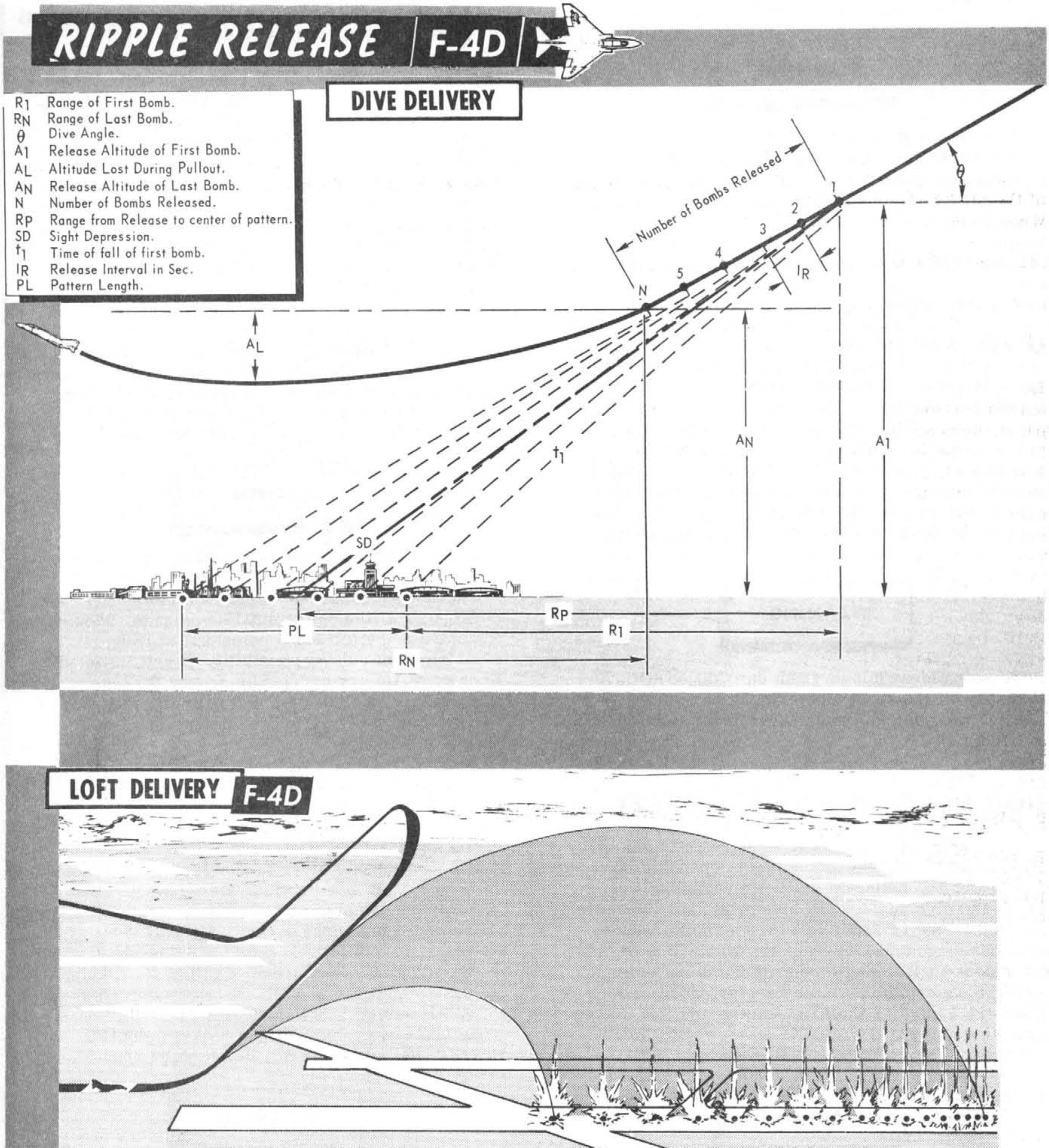
Level bombing and dive bombing tables are provided in T.O. 1F-4C-34-1-2 with dive angle from 0° to 45°. The sight depression angle given in the tables is computed to place the fire bomb on target; when it is desirable for the fire bomb to hit short of the target, the distance must be estimated or the sight setting recomputed using the Sight Depression charts in section VI. Wind corrections can be applied in the same manner as for the low drag bombs. Refer to Wind Correction, section V. The Dive Recovery charts must be used to determine the minimum release altitude.

WARNING

DO NOT FLY through FIRE BOMB SMOKE within 20 seconds of burst as a compressor stall or flameout could occur.

CBU DELIVERY

The direct, dive laydown, laydown, or the offset bombing delivery mode may be used to deliver the CBU munition with either a single release or ripple release. Low-level bombing, using the CBU munition consists of a low-level or low-angle approach to target at the predetermined speed and altitude above target. Crosswind correction is applied (in addition to crabbing the aircraft) by offsetting the flight path parallel to, and upwind of the no-wind ground track. Flight path offset, to correct for crosswind, is required by the high-drag CBU munition because of its longer time of flight. The optical sight establishes the release point when the direct delivery mode is used. The release point is automatically computed and release is automatically initiated by the weapon release computer set when the dive laydown, laydown, or offset bombing mode is used to deliver the CBU munition. Rangewind correction may be ignored for the CBU delivery. The bombing tables provide the sight depression angle from flight path that will place the first bomblet 500 feet short of the target. When it is desirable to change the impact point of the first bomb, the Sight Depression charts in section VI must be used to establish the sight depression from flight path.



1. PRIOR TO TRP, SELECT LOFT DELIVERY MODE AND SET UP THE MULTIPLE WEAPON RELEASE MODE.
2. WHEN OVER TRP, THE AC DEPRESSES AND HOLDS THE BOMB RELEASE BUTTON TO START THE PULLUP TIMER, THE PULLUP LIGHT ILLUMINATES AND THE HORIZONTAL AND VERTICAL POINTERS ON THE ADI CENTER.
3. WHEN THE STEADY TONE SOUNDS AND THE PULLUP LIGHT GOES OUT, ADVANCE THROTTLES TO FULL MIL POWER AND BEGIN PULLUP. (WITH THE MOTOR DRIVEN TIMER INSTALLED, A 0.25-SECOND WARNING TONE IS GIVEN PRIOR TO THE STEADY PULLUP SIGNAL.) FLY TO KEEP THE ADI POINTERS CENTERED UNTIL BUFFET ONSET, THEN FOLLOW THE BUFFET BOUNDARY.
4. WHEN THE SELECTED RELEASE ANGLE IS ACHIEVED, THE PULLUP LIGHT ILLUMINATES, AND THE STEADY TONE STOPS. THE AC WILL CONTINUE TO HOLD THE BOMB RELEASE BUTTON DEPRESSED UNTIL THE LAST BOMB IS RELEASED.
5. WHEN THE LAST BOMB IS RELEASED, INITIATE A WINGOVER TO ACHIEVE A 120° TURN WHILE DIVING TO ESCAPE AT MINIMUM ALTITUDE.

F4D-34-I-203

Figure 1-15

WARNING

When the dive delivery is used, a straight line flight path should be maintained during the release and for 2 seconds after the release; the minimum release altitude should be planned accordingly.

CBU DELIVERY USING THE SUU-7 DISPENSER

When a dive delivery is used for CBU series weapons using the SUU-7 dispenser, a straight line flight path should be maintained during the release and for 2 seconds after release. The minimum release altitude should be based on altitude lost during recovery plus altitude lost during the 2-second stabilized dive after release. This procedure is necessary to prevent voids in the bomb impact pattern whether using dispensers with or without modified tube extensions. The above procedure must be used when the dispenser is not modified with tube extensions to prevent bomb hang-up and possible subsequent early detonations.

WARNING

Do not release bombs from unmodified SUU-7 dispensers (without tube extensions) while the aircraft is in other than wings level stabilized flight.

HIGH DRAG GP BOMB DELIVERY

The high drag GP bombs can be delivered from altitudes between 100 feet to 3000 feet depending upon the bomb used, the fuzing limitation, fragmentation envelope and dive angle. The high drag characteristic provided by the retarder tail fin assembly reduces the bomb range and increases the bomb time of fall and impact angle. Single release bombing tables and ripple release bombing tables are provided in T.O. 1F-4C-34-1-2. Use the fuze Arming and Safe Escape chart, section VI.

WARNING

DO NOT FLY over or near burst area within 20 seconds of detonation as aircraft damage can result from flying debris. During training missions, at least 20-seconds spacing between aircraft must be observed when inert or sand filled bombs are released. In the training situation, observing the 20-second spacing between aircraft prevents a bomb-to-aircraft collision in the event a bomb releases low drag and ricochets into the air after impact.

MK82 (SNAKEYE I) AND M117R HIGH/LOW DRAG OPTION, IN-FLIGHT SELECTIVITY

The MK 82 (Snakeye I) and M117R GP bombs can be released in a low drag configuration (retarding fins remain closed) or a high drag configuration (retarding fins open after release) provided arming wire routing is accomplished during loading to provide these options. The high or low drag configuration is selected in flight through the arm nose tail switch on the multiple weapons control panel. Refer to Arming Wire/Lanyard Routing, part 4, for detailed information concerning the required arming wire configuration for this capability.

For a *high drag* release using the in-flight option, the *NOSE & TAIL* position is selected on the arm nose tail switch. The *NOSE* position is selected for a *low drag* release with only the nose fuze initiated. After T.O. 1F-4-805, the *TAIL* position may be selected for a *high drag* release with only the tail fuze initiated.

WARNING

Since certain mechanical and human errors inherent with this type delivery option can result in hazardous or degraded reliability situations, the operational commander should consider the following notes and warning which point out the possibility of self inflicted damage, injury to friendly ground forces, single fuze reliability, and delivery accuracy degradation before approving this option for operational use.

Note

With the approved arming wire routing for the in-flight high/low drag option, single fuze reliability (nose fuze only) is available with the low drag option. Dual fuzing reliability (nose and tail) is available with the retarded high drag option if the high drag bomb time of fall exceeds 6.6 seconds. If the high drag bomb time of fall is less than 6.6 seconds, only FMU-54 tail fuze arming is available. Single fuze reliability (tail fuze only) is available with the high drag option when the arm nose tail switch is positioned to TAIL.

WARNING

- When the MK 82 Snakeye I or M117R bombs are configured for inflight selectivity for high/low drag releases, the minimum nose fuze setting is 6.0 seconds for the M904E2 or M904E3 fuze; the minimum tail fuze setting for the FMU-54 fuze is 2.5 seconds. With current arming time tolerances, the minimum bomb time of fall to provide time for the fuzes to arm is 6.6 seconds for the nose fuzes and 2.8 seconds for the tail fuze (high drag arming only).

WARNING

- Under combat conditions, where a 6 second nose fuze arming delay setting may be inconsistent with operational requirements, a 4 second M904E2/E3 nose fuze arming delay setting may be used subject to the following restrictions:
- Dive Releases. For planned high drag dive releases, the release altitude must not exceed 1000 ft AGL.
- WRCS Dive-Toss Releases. For planned high drag dive toss releases, the pickle altitude must not exceed 1000 ft AGL.
- Level Releases. For planned level releases of high drag weapons and a straight and level escape maneuver, the release altitude must not exceed 250 ft AGL. This restriction does not apply for a single, pairs, or salvo type release if a 4G wings level pullup or a 4G 60° banked turn escape maneuver is executed immediately after release.

Note

None of the foregoing restrictions apply if the planned high drag bomb release altitudes exceed the minimum release altitudes that are required for safe escape for low drag MK 82 bombs.

WARNING

- With this in-flight option of high/low drag selection, strict adherence to the prescribed cockpit switchology is mandatory. If the AC inadvertently selects high drag, or experiences an arming solenoid malfunction when the intent is to release a low drag bomb, a fully armed high drag bomb would impact considerably short of the intended aimpoint. If friendlies are in the immediate area, this could result in disastrous consequences. Conversely, if the AC inadvertently selects low drag, or experiences an arming solenoid malfunction when the intent is to release a high drag bomb during close-in attack conditions, the result (if the bomb time of fall is less than 6.6 seconds) would be an unarmed bomb with an initial impact considerably downrange of the intended impact point. This could also result in disastrous consequences if friendlies are in the area; particularly if the bomb detonates, or ricochetes and then detonates. If the bomb time of fall exceeds 6.6 seconds in this case, a fully armed low drag bomb would impact considerably downrange from the intended impact point.
- There is also a possibility of the delivery aircraft suffering self-inflicted fragment damage if an intended high drag bomb releases low drag during a close-in attack condition, and for some reason detonated at initial impact. To provide an additional margin of safety in this event, the pilot should execute a 4-G pullup or a 4-G, 60° banked escape maneuver immediately after release.
- Minimum release altitudes with respect to fragment envelope clearance should be observed even if the bomb is released SAFE. This would protect the aircrew in the event of an arming wire hang-up, solenoid malfunction, etc, resulting in an arming wire being extracted and the bomb becoming fully armed.

Note

If the retarded bombs are configured to exclude any cockpit selection of a low drag munition release, a 2.0-second nose fuze arming delay setting may be used if nose fuze arming wire withdrawal is initiated by retarded fin opening action.

WARNING

If high drag ripple releases of the M117R or MK 82 Snakeye I bombs are anticipated using the in-flight high/low drag option selectivity, the munitions must be loaded in the configuration specified in T.O. 1F-4C-1 for this type release.

LEAFLET BOMB DELIVERY

The weapon release computer set can be used to locate the target and automatically release the leaflet bomb. The offset bombing mode, the laydown mode, the dive laydown, or the direct delivery mode can be used for leaflet bombing. The M129E1, E2 leaflet bomb is released from altitudes of 4000 feet through 11,000 feet. The bombing table T.O. 1F-4C-34-1-2 states the bomb time of flight and range from release to burst for a given level flight release true airspeed and release altitude above target. The time of flight is used to set the mechanical time delay fuze for a 3000-foot detonation. The bomb range is used to estimate the release point. Various wind effects on the bomb prior to burst is a function of wind velocity and bomb time of flight. The wind effect on the leaflets after detonation and during the descent is difficult, if not impossible, to predict.

FLARE DISPENSING

The SUU-25A/A, B/A, C/A flare dispenser is used to deliver the MK 24 flares. The delivery aircraft approaches the target in level flight at the preplanned

release altitude. The MK 24 flare profile and parameters are illustrated in figure 1-16. Release airspeed is not a critical parameter. Release altitude is critical only when it is desirable to have flare burnout above the ground. The flare dispensing table T.O. 1F-4C-34-1-2 provides the minimum release altitude AGL for flare burnout at impact. The desired burnout altitude AGL must be added to the minimum release altitude AGL to determine the actual release altitude AGL. The flare dispensing table also provides the horizontal distance traveled and vertical drop of the flare prior to ignition. The flare ejection fuze delay time and the flare ignition fuze delay time is set according to mission requirements and the data on the flare dispensing table. To properly position the flare at ignition, rangewind effect and crosswind offset (ft) may be determined by multiplying the rangewind or crosswind component (kts) times 1.7 times the sum of the ejection and ignition fuze delay settings.

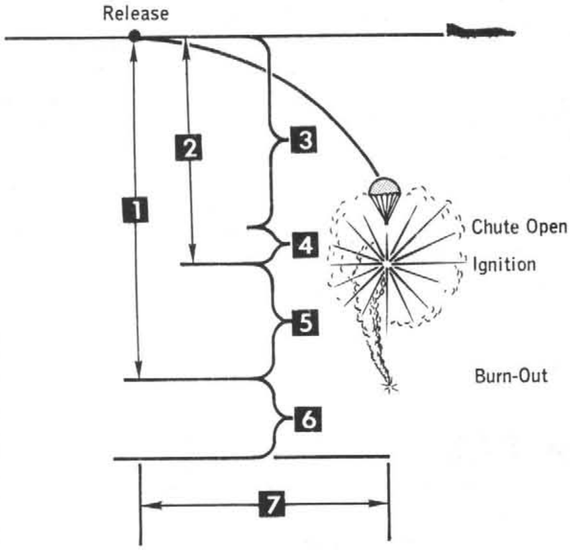
LOFT BOMBING

Note

On F-4D-32 and up; and all others after T.O. 1F-4-702, the aircrew may energize and use the WRCS target find mode along with any LABS mode selected, including DIRECT. The modification includes the addition of the weapon delivery panel (figure 1-17) added to the rear cockpit. Refer to LABS/WRCS Delivery Mode, this section.

The loft bombing mode combines the use of the multiple weapons release system (MWRS) with the attitude reference and bombing computer set (ARBCS). The purpose of the loft bombing mode is to provide ripple relase capability of GP bombs from low altitude with a minimum of aircraft exposure time to groundfire and without a target fly-over. This is accomplished as illustrated in figure 1-15.

MK 24 FLARE PROFILE F-4D



1. Minimum release altitude AGL required to provide flare burnout.
2. Vertical drop prior to flare ignition.
3. Ejection fuze delay time.
4. Ignition fuze delay time.
5. Flare Burning Time:
   a. Mod 3: 180 sec.
   b. Mod 4: 198 sec.
6. Desired flare burnout height AGL.
7. Horizontal flare travel prior to ignition.

4C-34-1-1-(19)

Figure 1-16

During mission planning, an IP (Identification Point) is selected on the target map, or photos, that is located near and on course to the target; the pullup point is established; the release angle of the first and last bomb, the pattern length of the bombs, and the pullup timer setting are also defined.

Prior to the bombing run, the pedestal panel is set up for a bombs ripple release with the master arm switch in ARM and the stations selected; and the delivery mode selector knob is positioned to LOFT. The LABS bomb release angle computer automatically initiates the ripple release when the aircraft pitch attitude is equal to the preset release angle. The approach to the IP is performed at a preplanned altitude AGL and airspeed. At the IP, the bomb button (pickle button) is depressed and must be held energized until the final bomb is released. Depressing the bomb button starts the pullup timer. At the completion of the pullup timer, a pullup signal is given and the AC begins a 4 G in 2 seconds pullup. When the aircraft attitude is at the preselected angle the bomb release angle computer automatically initiates the ripple release. The AC continues the pullup until the last bomb is released. When the last bomb is rippled off, the bomb button is released, and the AC begins a wing-over escape maneuver to achieve a 120° turn while diving to escape at minimum altitude.

Note

> After T.O. 1F-4-702, the gyro FAST ERECT switch is added to the aux. armament control panel (figure 1-17). The AC may use the switch to momentarily cage the AN/AJB-7 gyros and correct any gyro precession during the level, constant speed target run-in. Refer to LABS/WRCS Delivery Mode, this section.

The following is a more descriptive analysis of the LOFT release system function. When LOFT is selected and the optical sight is operated in the A/G mode, the optical sight is pitch stabilized with reference to the horizontal platform, and can be manually depressed. The sight is not drift stabilized. The sight reticle light will follow the pullup indications (pullup light ON - reticle light ON, pullup light OFF - reticle light OFF). Either bomb button (front or rear cockpit) is depressed over the IP. This starts the pullup timer countdown. Refer to Loft Bombing Controls, this section. Bomb button power also energizes relays which illuminate the pullup light, and which move the horizontal and vertical pointers of the ADI into view over the center of the sphere. The vertical pointer indicates yaw/roll light deviations and the horizontal pointers show deviations from 1.0 G flight. The appearance of the pointers indicates that the ARBCS has properly switched into the LOFT bombing function. At the end of the total time interval, pullup voltage is applied to the tone generator producing a continuous audible tone. The pullup light circuit is deenergized and the light goes off. These are the direct indications to begin pullup. The AC should select MIL power and begin rotation into the pullup maneuver. As the timer-complete contacts close, voltage is applied to one side of the low and high angle release switches, which are not yet energized. Relays in the flight director bombing computer are energized to start the G programmer. The ADI horizontal pointer now indicates G error based on 4 G obtained in 2 seconds. The horizontal pointer deflects upward unless the AC begins pullup.

When the aircraft reaches the preset pitch attitude, the release angle switch closes and applies the release signal. As release voltage is applied, the tone generator is deenergized, the timer is reset, and the pullup light illuminates. This is the signal that automatically begins the ripple release. The AC continues to hold the bomb button depressed and the G program will continue to be displayed by the ADI horizontal pointer as an aid in completing the maneuver. The vertical pointer, however, is deflected out

of view at release. When the AC releases the bomb button, all bombing voltage is removed and the horizontal pointer deflects out of view, and the pullup light goes off.

Note

During the LOFT mode, once the bomb button is depressed, it must remain depressed until final bomb release. If the bomb button is released before the first bomb is released, an interlock circuit is energized and the run cannot be continued by depressing the bomb button. To overcome the interlock, the bomb mode selector knob must be positioned out of the LOFT function and then returned to LOFT.

The LADD bombing system can be used to perform the loft bomb delivery. This is accomplished by selecting the LADD mode on the bomb mode selector switch and setting the pullup to release time (from the bombing tables) on the Release Timer. The release signals are the same as for the loft bombing mode. The horizontal needle on the ADI sphere will program 3.5 G in 1.5 seconds (not 4.0 G in 2 seconds as for the loft mode) until approximately 38° pitch attitude is achieved. Therefore, the ADI cannot be used above 38° when the LADD bombing system is used to accomplish the loft delivery, the aircraft accelerometer must be used to establish the pullup acceleration until buffet onset.

AIRCRAFT WEAPON SYSTEM CONTROLS (F-4D)

The following is a general description of the controls and indicators (figure 1-17) that comprise the F-4D non-nuclear weapon delivery system. The controls and indicators are described briefly to augment the detailed description of various delivery modes which follows. The following major components comprise the non-nuclear weapons delivery system, excluding air-to-air missile delivery.

a. Delivery mode selector panel.
b. Weapon delivery panel.
c. Station and weapon selection panel.
d. Weapons release computer set (WRCS) AN/ASQ-91.
e. Lead computing optical sight system (LCOSS) AN/ASG-22.
f. Inertial navigation set (INS) AN/ASN-63.
g. AN/APQ-109A radar set.
h. Attitude reference and bombing computer set (ARBCS) AN/AJB-7.

DELIVERY MODE SELECTOR PANEL

The delivery mode selector panel (figure 1-17) is in the front cockpit on the main instrument panel, placarded LABS on the left, and WPN REL on the right. The selector knob is used to select one of twelve delivery modes. The six LABS delivery modes are placarded DIRECT, TIMED LEVEL, TIMED LADD, TIMED O/S, LOFT, and INST O/S. The DIRECT position is used for bombing, rocket, or gun firing with a fixed, depressible sight. The LOFT position is used to perform the loft bomb ripple release mode (see the preceding note). The OFF position removes power from the WRCS on the LABS bombing modes thereby preventing a release signal from reaching the bomb release relay. The guns and AIM missiles can be fired with the mode selector switch in the OFF position or any other position. The six WRCS delivery modes are on the right side of the mode selector knob, placarded WPN REL: TGT FIND (target finding), DIVE TOSS, DIVE LAY (dive laydown), LAYDOWN, OFFSET BOMB, and AGM-45. The nuclear stores jettison button is in the center of the mode selector knob, placarded NUCLEAR PUSH TO JETT; refer to Jettison Controls, this section.

WEAPON DELIVERY PANEL

The weapon delivery panel contains the switches by which the aircrew may select an integrated AJB-7/WRCS delivery mode. The three switches on this panel are described with the delivery mode. For a description of the system, refer to LABS/WRCS Delivery Mode.

STATION AND WEAPON SELECT PANEL

The station and weapon select panel (figure 1-17), on the front cockpit pedestal, contains the switches that control and select all phases of non-nuclear weapon delivery, excluding air-to-air missile delivery.

MASTER ARM SWITCH

The master arm switch has two positions, SAFE and ARM. In ARM, power is supplied to the bomb button transfer relay and the arm nose tail switch. Application of power energizes the bomb button transfer relay and the function of the bomb button (pickle button) is transferred from the nuclear weapons system to the non-nuclear weapons system. (Refer to Bomb Transfer Relay, this section.) The switch must be in ARM to deliver all non-nuclear weapons, excluding air-to-air missiles. Nuclear weapons can be

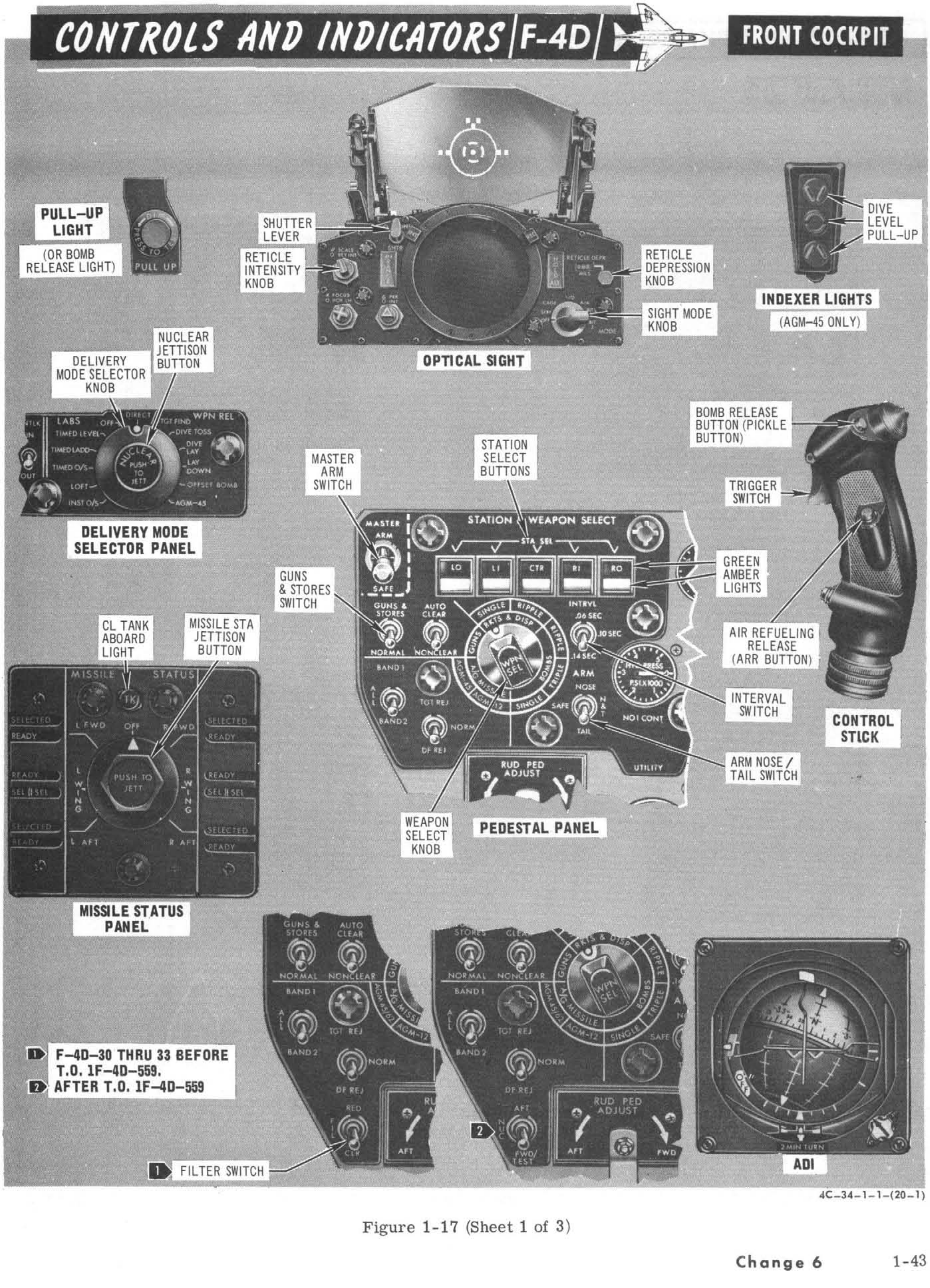


Figure 1-17 (Sheet 1 of 3)

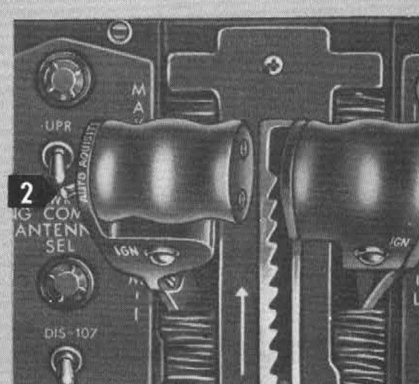
CONTROLS AND INDICATORS F-4D

FRONT COCKPIT

DCU-94/A CONTROL MONITOR
F-4D thru Block 33

AUXILIARY ARMAMENT
CONTROL PANEL

HSI



AUTOMATIC AQUISITION SWITCH

1 Block 32 and Up.
Block 24 thru 31, After T.O. 1F-4-702.

2 Block 32 thru Block 33.
Block 24 thru Block 31 After incorporation of T.O. 1F-4D-513.

F4D-34-1-205-2

Figure 1-17 (Sheet 2 of 3)

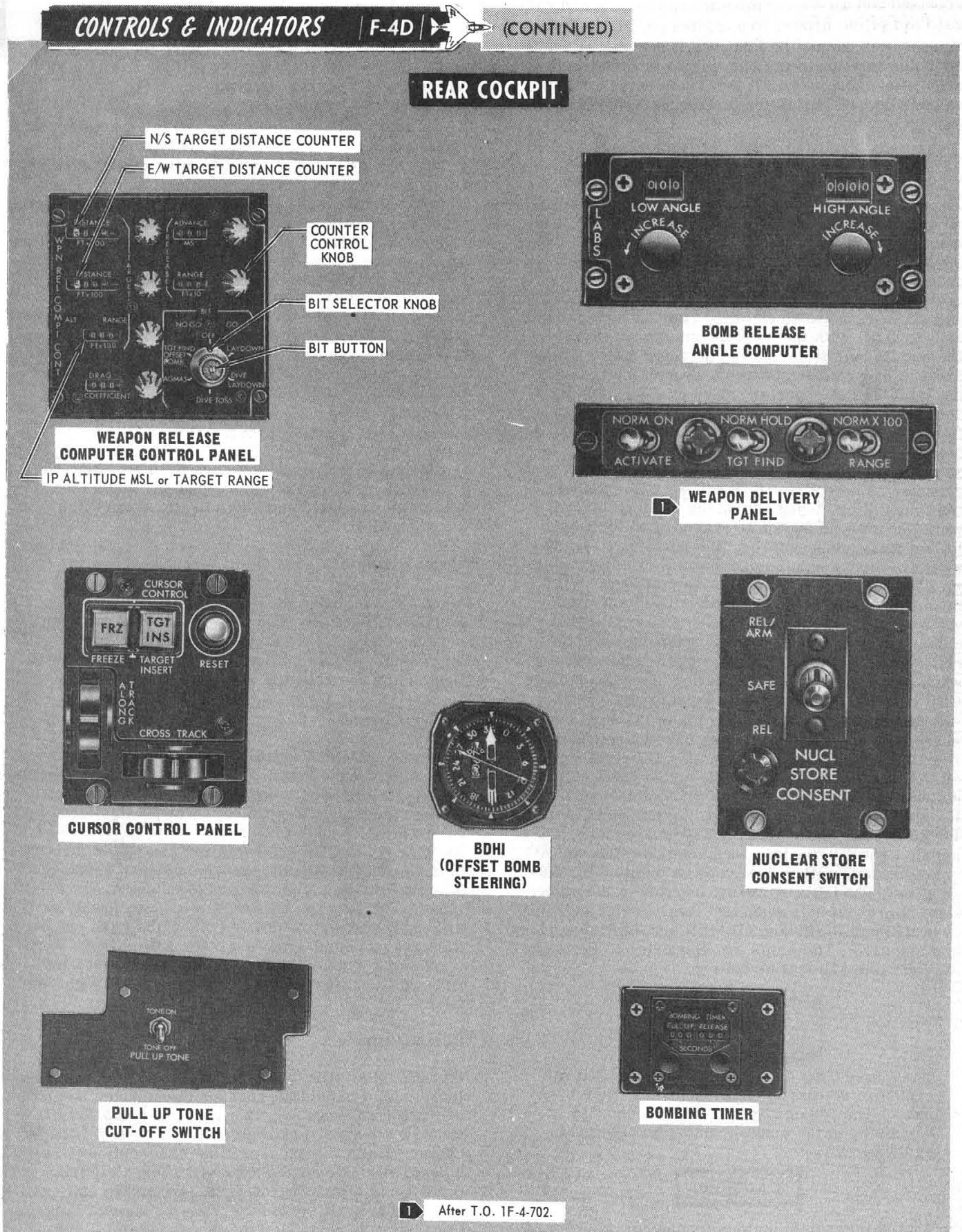


Figure 1-17 (Sheet 3 of 3)

released and air-to-air missiles can be launched regardless of the master arm switch position. Air-to-air missiles can not be launched if the trigger transfer relay is energized. The trigger transfer relay can not be energized until the bomb button transfer relay is energized. Refer to Trigger Transfer Relay.

STATION SELECTOR BUTTONS

The five station selector buttons are push-on push-off switches, placarded LO (left outboard), LI (left inboard), CTR (center), RI (right inboard) and RO (right outboard). The buttons remain in detent when pushed off. The top half of the button illuminates green when the button is pushed ON and goes out when pushed OFF, regardless of the position of the master arm switch. With the master arm switch in ARM, the bottom half of the station selector button illuminates amber to indicate that a weapon is aboard if the MER/TER stepper switch is positioned on an active position (1 thru 6 or 1 thru 3). The amber light will not illuminate if the MER/TER is not homed or is OFF. Therefore, a hung bomb would not produce an amber light until the MER/TER is rehomed by selecting RKTS & DISP. The amber light may blink (depending on the stations loaded) while the stepper switch is recycling to the first loaded station encountered, and illuminate steady when positioned on a loaded station. The light illuminates when RKTS & DISP is selected even when bombs are aboard. The amber light illuminates when a single weapon is loaded directly to the MAU-12 armament pylon and goes off when the weapon is released or jettisoned. The amber light goes out when all weapons from the station are released, or CBU's fired. When CBU dispensers are aboard, the light begins flashing when any of the CBU dispensers on the selected station has two releases remaining, and goes out when all CBU dispensers on that station are empty. The amber light will not go out when all rocket pods or flare dispensers from the station have been fired out. When the AC selects BOMBS to release the empty CBU dispensers, the amber light illuminates, then goes out when the AC releases the empty rocket pods or empty CBU dispensers. The CBU indicating function of the amber light is present only when the weapon selector knob is in RKTS & DISP, and all MER and TER stow plugs are installed. The lights are connected to the warning light dim and test circuitry.

WARNING

The empty CBU indication establishes that all explosive detents in the dispenser(s) have been fired. The possibility of a hung bomblet(s) remaining in the tube(s) can not be assessed by the aircrew.

CAUTION

The station select buttons (outboard) immediately energize the SUU-23 gun pod prestart circuits and start the gun inertial motor. To avoid inertial motor burn-out, avoid selecting the stations during ground operations or any operations not directly involving the gun pod.

WEAPON SELECTOR KNOB

The weapon selector knob is a rotary type switch with eight positions, used to select the type of weapon (bomb, rockets, guns, or AGM missiles) and the release or firing sequence (single, triple, or ripple). Refer to figure 1-18, F-4D Normal Release Sequence. When the BOMBS positions are selected, the selection on the delivery mode selector panel may be in any bombing mode to obtain a bomb release. When the RKTS & DISP position is selected to fire the rocket launchers, only the DIRECT position on the delivery mode selector panel can be used. When the RKTS & DISP position is selected to fire the CBU or flare dispensers, the selection on the delivery mode selector panel may be DIVE LAY, LAYDOWN, OFFSET BOMB, or DIRECT.

Note

When the weapon select knob is in the AGM-45 position, IR missile status and the audio tone is not available until the missile arm switch is in ARM.

Bombs/Single

When the weapon selector knob is positioned to BOMBS/SINGLE, one bomb is released from each station selected when the bomb release button is depressed. If five stations are selected and loaded, five bombs are released simultaneously.

Bombs/Triple

When the BOMBS/TRIPLE position is selected and the bomb release button held depressed, three bombs are ripple released, regardless of the number of stations selected, in a timed interval established by the position of the interval switch: 0.06 SEC, 0.10 SEC, or 0.14 SEC. The bomb release button must be held depressed until the three bombs are released. When a left and a right station is selected, the release pulse is directed alternately between the left and right station to release two bombs from one side and one bomb from the other side. There is no provision for determining which side receives the first release signal, the left station or the right station.

Bombs/Ripple

When BOMBS/RIPPLE is selected and the bomb release button is held depressed, the selected bombs are released singularly in a timed interval established by the position of the interval switch. Bombs continue to be released until the bomb button is released. The bombs are released alternately from the left and right wing stations. When five stations are selected, all the bombs from the outboard stations are released, then the inboard station, and finally the centerline station. (If the pilot selects both stations on one wing, i.e., LO and LI, then

NORMAL RELEASE SEQUENCE F-4D

5 STATIONS LOADED, 5 STATIONS SELECTED

Note

When two or more stations are selected, there is no indication which station receives the first release pulse, left or right. Normally, the left station receives the first release pulse.

SINGLE

Each bomb button signal simultaneously releases one bomb from each selected station.

RIPPLE

Holding the bomb button depressed releases bombs continuously in the left-right order and at the selected bomb release interval.

TRIPLE

Holding the bomb button depressed releases three bombs in the ripple release sequence and at the selected bomb release interval.

The MER and TER release sequence always remains as illustrated here. Empty points are automatically stepped over.

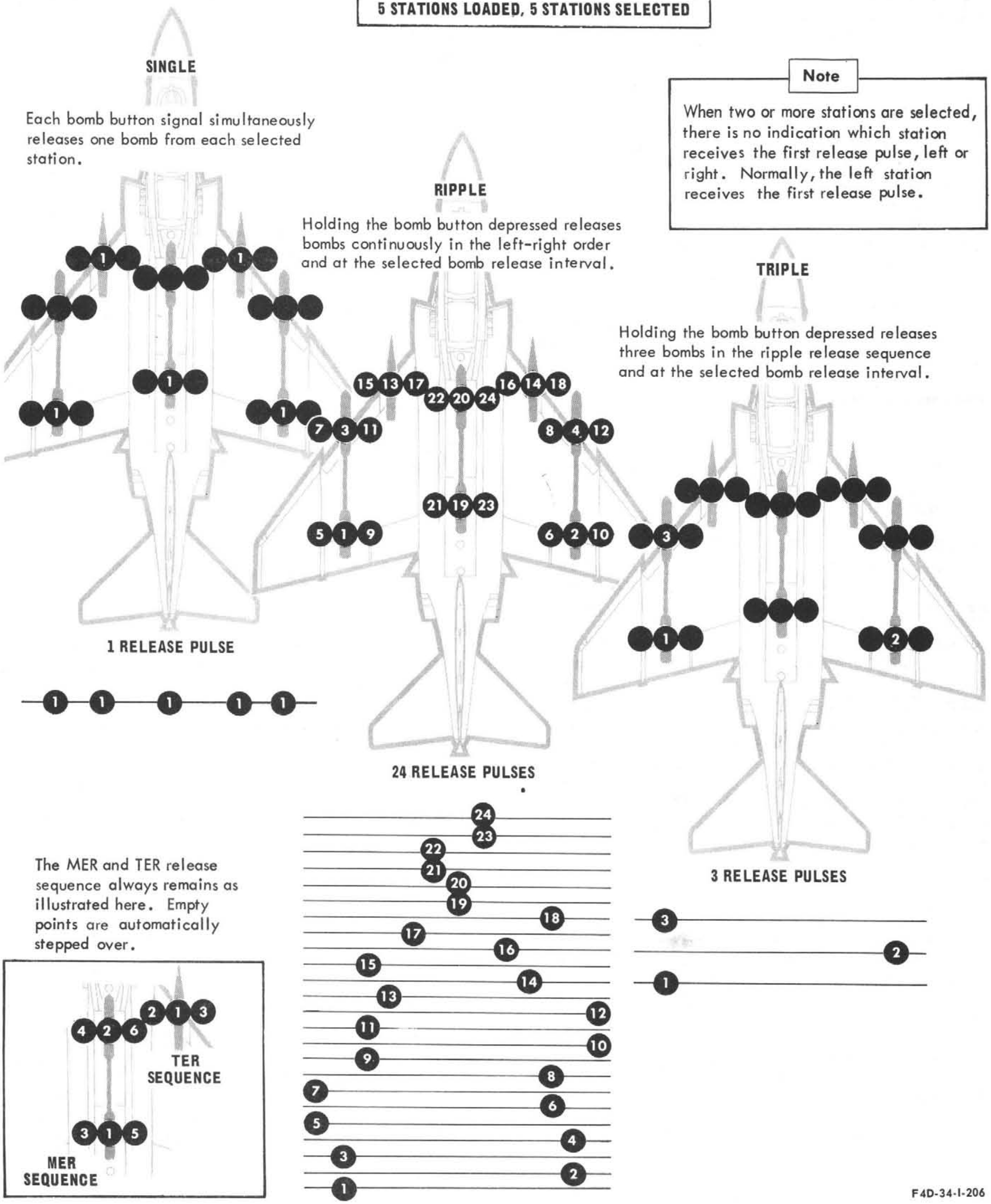


Figure 1-18

weapons release alternately from each of the stations.) There is no provision for determining which side (left or right wing station) receives the first release pulse; normally the left side receives the first release pulse.

Rockets and Dispenser/Single

Note

> When the SUU-21/A dispenser is loaded on the inboard station, bomb release will not occur if the weapon selector knob is on RKTS & DISP.

Selecting RKTS & DISP and depressing the bomb release button will fire-out one rocket pod or release a predetermined number of tubes from one dispenser, from each station selected. If five stations are selected, five rocket launchers will fire-out simultaneously. Only the DIRECT position can be used to fire the rocket launchers.

Rockets and Dispenser/Ripple

Note

> The firing pulse in the ripple mode is not sufficient duration to completely fire-out the entire rocket launcher.

With RKTS & DISP/RIPPLE selected and the bomb release button is held depressed, the selected dispensers will be fired singly in a timed interval established by the position of the interval switch, 0.06 SEC, 0.10 SEC, or 0.14 SEC. Ripple firing pulses continue until the bomb button is released. The firing pulses alternate between the left and right station. When five stations are selected, only the outboard station CBU is fired out. The firing pulses will not transfer to the inboard stations until the outboard station selector buttons are pushed OFF. Likewise, the firing pulses will not transfer from the inboard stations to the centerline station until the inboard station selector buttons are pushed OFF. There is no provision for determining which station (left or right) receives the first firing pulse.

Guns

The gun pods are selected by placing the weapon selector knob to GUNS, depressing the LO, CTR or RO station selector buttons, and placing the master arm switch to ARM. The gun located on the station(s) selected will receive firing voltage when the trigger switch is pulled. The guns can also be selected and fired, regardless of the weapon selector switch position, when the guns and stores switch is positioned to GUNS & STORE, the master arm switch is in ARM, and the gun station selected. The centerline gun cannot be fired if the nose gear is extended; this will not affect the firing capability of the outboard guns. Refer to Trigger Switch and Trigger Transfer Relay.

A/G Missiles

The A/G MISSILES position is not a safe position for bombs. Bombs are released when the station is selected and the bomb button depressed, as if BOMBS SINGLE is selected. The A/G missile position is used to select the AGM-12B/C missile and the AGM-45 missile. The AGM-45 placard is changed to AGM-45/62 to include the selection of the MK 1 MOD 0 guided weapon.

Arm Nose Tail Switch

This switch (figure 1-17) completes the circuit between the master arm switch and the arming solenoids in the aircraft ejector racks (MAU-12, BRU-5/A, and MER/TER). The energized solenoids retain the arming wire swivel loops and as munitions are ejected, the arming wires are pulled to initiate the fuze arming sequence. In the SAFE position, the arming wires are retained by the munition during separation from the aircraft and the associated fuze remains SAFE.

The arm nose tail switch also provides the selective high/low drag capability for those weapons which may be rigged for either a freefall or retarded drop. In this case, the solenoids are energized to apply the holding force for the lanyards which deploy the retardation device. (Refer to M117R and MK 82 Snakeye I bombs, and Arming Wire Routing, part 4.)

WARNING

> If this switch is used to select the M117R or MK 82 (Snakeye I) high/low drag release option in flight, the warnings and notes listed in Mission Description, High Drag GP Bomb Delivery, must be carefully observed.

The switch positions and corresponding solenoids armed are shown below.

Switch Position	Solenoid Armed
SAFE	None
NOSE	Fwd and Ctr
TAIL	Aft
NOSE & TAIL	Fwd, Ctr, and Aft

There is no center solenoid on the MER/TER and BRU-5/A ejector racks.

With MER/TER equipment that do not have automatic homing, the arm nose tail switch must be in the NOSE or NOSE & TAIL position to apply power through the sensing switch to the MER/TER stepper solenoid. Then with a partial load of bombs aboard, the empty stations are bypassed and the AC releases one bomb with each pickle signal. The TAIL position does not apply the stepping voltage and an extra pickle must be delivered to step through each empty MER/TER station.

With MER-10A and TER-9A equipment that have automatic homing, empty stations are bypassed regardless of the arm nose tail switch position.

INTERVAL SWITCH

The interval switch is used only during BOMBS/RIPPLE, BOMBS/TRIPLE, and RKTS & DISP/RIPPLE modes on the weapon selector knob, to establish interval between each release. The switch has three positions (0.06 SEC, 0.10 SEC, and 0.14 SEC) that determine the pulse interval: the pulse length or duration is always the same (23 to 33 milliseconds). The pulse rate is measured from the start of each pulse and therefore includes the pulse duration. The pulse rate tolerance of the various release intervals are: 60 to 90, 100 to 115, and 140 to 161 milliseconds.

GUNS AND STORE SWITCH

The guns and store switch has two positions placarded GUNS & STORE and NORMAL. The purpose of the guns and store switch is to permit the AC to fire the guns regardless of the weapons selector knob position. Placing the switch to GUNS & STORES performs the same function as placing the weapons selector knob to GUNS; however, the function of the optical sight is determined by the delivery mode and weapon selected. When the switch is positioned to NORMAL, the guns cannot be fired unless the weapon selector knob is in GUNS.

GUN CLEAR SWITCH

The gun clear switch has two positions (AUTOCLEAR and NONCLEAR) to select the gun mode of operation. When the autoclear mode is used, unfired rounds are extracted from the gun and ejected overboard. When the nonclear mode is used, the unfired rounds remain the gun. The NONCLEAR position is selected when the gun is to be fired in short bursts. When the guns have been fired in the NONCLEAR mode and not completely fired out, a final burst must be fired with the switch positioned to AUTO-CLEAR to clear the guns. If the gun is fired out in the NONCLEAR mode, the bolt assemblies automatically clear.

REJECT SWITCH

The reject switch is applicable to the AGM-45 missile DF control circuits. Refer to the AGM-45 missile system in T.O. 1F-4C-34-1-1A.

BAND SWITCH

The band switch is intended for use with the AGM-45 missile system. The switch, however, has no function at the present time.

FILTER SWITCH

The filter switch is functional in the filter control network of the Mark 1 Mod 0 weapon. See T.O. 1F-4C-34-1-1A.

Note

If the aircraft is configured with a SUU-42A/A jumper bundle (53-09790-107) at the outboard stations, the filter switch must be maintained in the RED position to get release and transfer voltage to the inboard and CL stations.

TRIGGER SWITCH

The front cockpit trigger switch is on the control stick. When the spring-loaded switch is actuated, power is supplied to the clutch/brake solenoid to initiate gun rotation and start the ammunition feed system. The gun will start firing when the trigger switch is pulled and cease firing when the trigger is released. Power can be removed from the trigger switch by pulling the gun power circuit breaker, No. 1 panel. The trigger switch in the aft cockpit is always inoperative. Refer to SUU-16/A-23/A Gun Pod, this section. For missile launching, refer to T.O. 1F-4C-34-1-1A.

WARNING

The trigger switch requires very little movement to initiate gun firing; therefore, the AC should place his finger on the trigger only when the gun is to be fired.

Trigger Transfer Relay

The trigger transfer relay must be energized to fire guns and must be deenergized to launch air-to-air missiles. To fire guns, the trigger transfer relay is energized by selecting guns and energizing the bomb button transfer relay as follows:

a. The bomb button transfer relay can be energized by positioning the master arm switch to ARM, and the DCU-94/A master release lock switch AFT.
b. Guns can be selected by positioning the weapon selector knob to GUNS or by positioning the guns and stores switch to GUNS & STORES.

Note

- When the trigger transfer relay is energized, all missile status lights on the missile status panel will go out. The TK light remains on if the tank aboard relay is energized. The tuned-up status of the missiles is not affected.
- The nose gear up limit switch must be energized to fire the centerline gun pod. The outboard gun pods can be fired regardless of the nose gear up limit switch position.

To launch air-to-air missiles, the trigger transfer relay must be deenergized. If guns are selected, the trigger transfer relay is deenergized by positioning the master arm switch to SAFE.

AIR REFUELING RELEASE (ARR) BUTTON

AIM-4D Coolant Supply Mode
(AFTER T.O. 1F-4D-508).

Refer to T.O. 1F-4C-34-1-1A section I, part 4, AIM-4D Missile and AIM-9 Missile.

RETICLE CAGING MODE
(AFTER T.O. 1F-4D-514).

Refer to Lead Computing Optical Sight, this part.

BOMB BUTTON

The bomb or pickle button (figure 1-17) is a small red button on the left side of the control stick grip in the forward and rear cockpit. The button is spring-loaded to OFF. Depressing the bomb button (in either cockpit) releases all air-to-ground weapons selected on the multiple weapons control panel or the DCU-94/A monitor-control panel. Power can be removed from the bomb button by pulling the A/G weapon release cont circuit breaker, No. 1 panel.

Bomb Button Transfer Relay

The bomb button transfer relay transfers the release signal, when energized, from the DCU-94/A panel controls to the pedestal panel controls. The relay is energized when the master arm switch is positioned to ARM, providing one of the following switches is positioned AFT or SAFE:

a. DCU-94/A all station selector switches - AFT.
b. DCU-94/A master release lock switch - AFT.
c. Nuclear store consent switch - SAFE.

If one of the station selector switches, the master release lock switch, and the nuclear store consent switch are energized, the bomb button transfer relay deenergizes (nuclear release) regardless of the master arm switch position.

Note

The DCU-94/A UNLOCKED lights for the wing stations (except the RO) illuminates when power is applied to the aircraft, if the inflight lockout pins are installed in the armament pylons.

AUTOMATIC ACQUISITION SWITCH

(After T.O. 1F-4D-513)

The automatic acquisition switch is on the left throttle handle (figure 1-19). The landing lights switch, formerly on the left throttle handle, is now on the left vertical panel in the vacancy provided by elimination of the emergency speed brake retract switch.

The purpose of the automatic acquisition mode is to provide the AC with the capability to lockon a target with the aid of the optical sight. With the sight in (A/A) air-to-air the sight line will be parallel with the radar boresight line. Refer to T.O. 1F-4C-34-1-

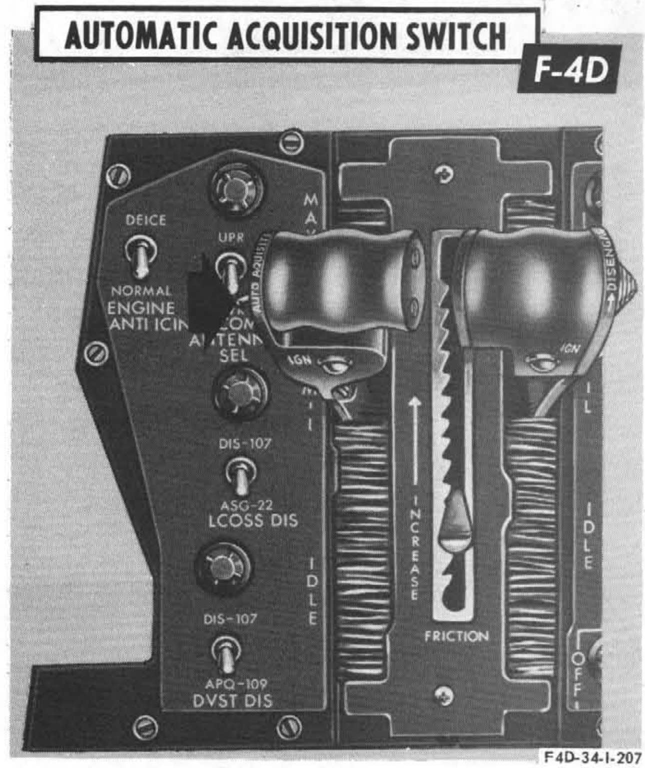


Figure 1-19

1A for a complete description of the operational application.

PULLUP LIGHT

The pullup light on the front cockpit instrument panel is a press-to-test type light. The lamp intensity can be controlled by rotating the outer ring to vary the size of the iris over the lamp. The pullup light illuminates when a bomb release signal is generated and goes out when the bomb button is released. For the description of the pullup light function during the loft bombing mode, refer to Loft Bombing, this section.

PULLUP TONE

(After T.O. 1F-4D-516)

An audio tone is present in the headset (for all WRCS modes except AGM-45) when the bomb button is depressed and continues until a bomb release signal is generated. The tone is generated by the AN/AJB-7 audio tone generator and is not broadcast. For a description of the audio tone function during the loft bombing mode, refer to Loft Bombing, this section.

BALLISTIC COMPUTER ADJUSTMENTS F-4D

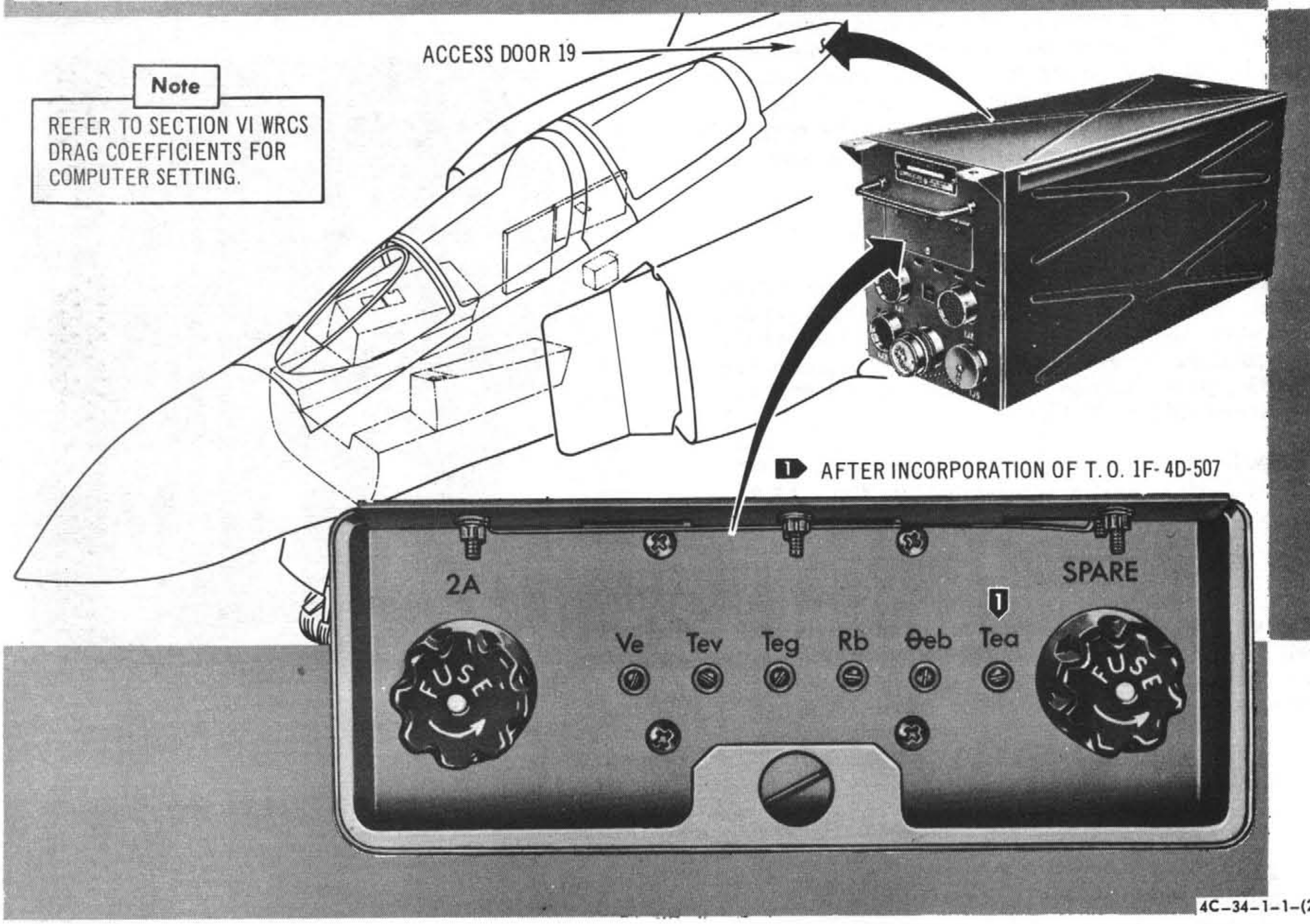


Figure 1-20

PULLUP TONE CUT OFF SWITCH

The pullup tone cut-off switch is on the left console, rear cockpit. The switch enables the aircrew to preclude external transmission of the audio tone during any bombing mode in which the tone signal is involved. With the switch in TONE ON, the audio tone signal is transmitted through the UHF transmitter. The TONE OFF position deenergizes the same tone transmit circuit. In either case, the aircrew hears the tone and all tone functions remain the same.

WEAPONS RELEASE COMPUTER SET

The AN/ASQ-91 weapons release computer set (WRCS) is designed to aid the aircrew in the delivery of non-nuclear weapons. The WRCS has two low-level bombing modes, LAYDOWN and DIVE LAYDOWN and two navigational modes, TARGET FINDING and OFFSET BOMBING that aid the aircrew in locating the target and performing a low-level bombing mission.

The WRCS consists of three units (figure 1-21): the ballistics computer in door 19; the weapons release computer control panel (WRCS panel); and the cursor control panel, in the rear cockpit on the right console. These units are now modified to accept aircraft changes specified by T.O. 1F-4D-507 and T.O. 1F-4-702. WRCS operating power is received from the inertial navigation set (INS) and aircraft power sources.

The accuracy of the weapons release computer is directly related to the input parameters received from the inertial navigation set (INS) and other associated systems when employed. The INS accuracy should be at least maintained at 5.0 nautical miles of error per hour (CEP). The ground speed indicator error (while the aircraft is not moving) should not be greater than 18 knots in 2 hours of navigation time. However, a higher degree of accuracy can be obtained which will produce greater bombing accuracy. The following suggestions are offered.

a. The accuracy of the INS should be maintained at 3 nautical miles of error per hour of CEP by checking the actual error after each flight and having the computer gyro bias adjustments made by the ground crew with the equipment installed in the aircraft. Even 2 NM/hour of CEP is obtainable.

b. After each flight, the aircrew should note the ground speed indicator error while the aircraft is not moving; the indication should not be greater than 8 knots per hour of navigation time.

WEAPONS RELEASE COMPUTER SET F-4D

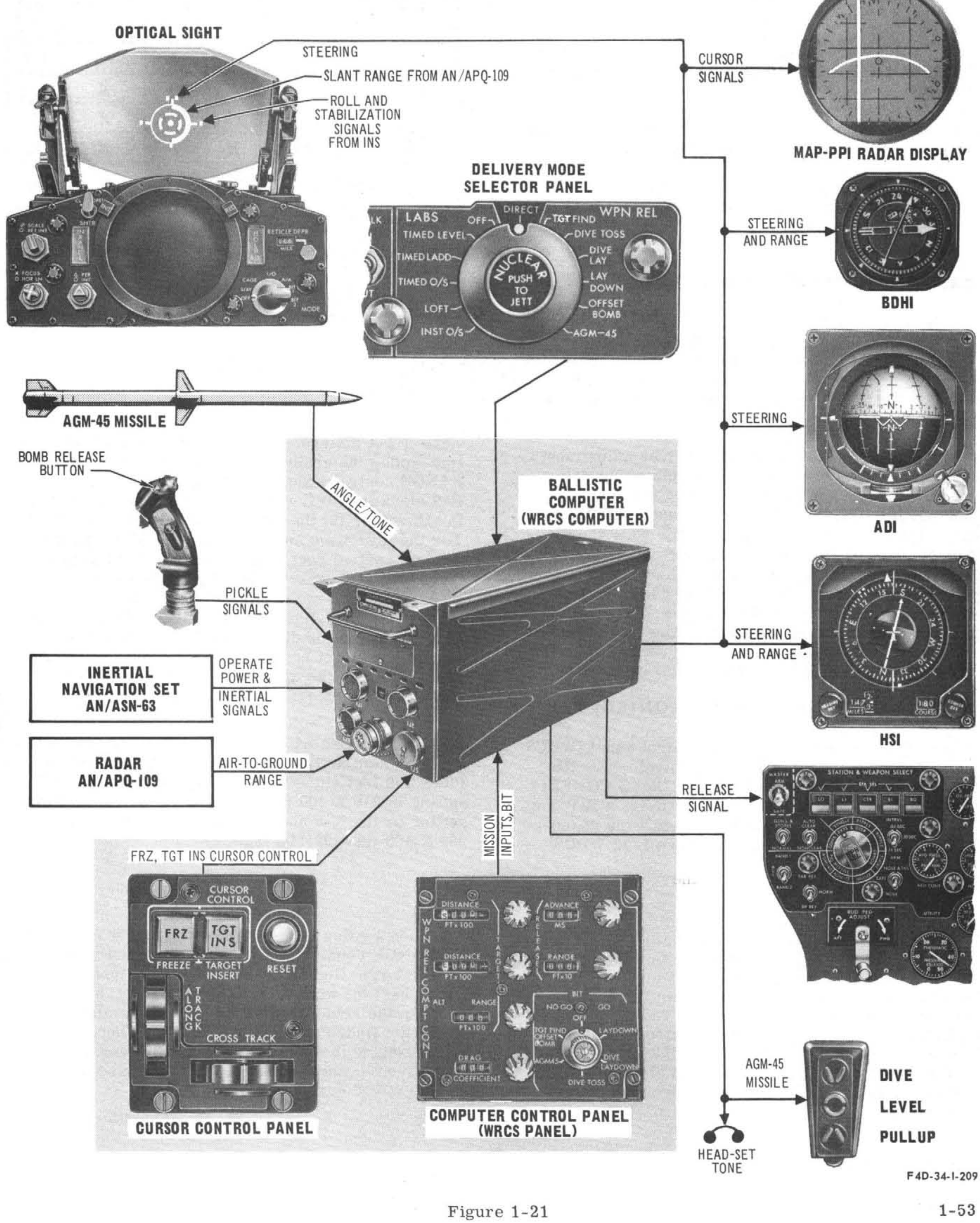


Figure 1-21

Note

> Looseness in the ground speed/ground track resolver can cause an erroneous readout: however, the readout is lower than actual and should not present a problem.

c. The INS double alignment procedure outlined in flight manual T.O. 1F-4C-1 produces greater WRCS accuracy.

d. The boresight procedures used by the ground crew should ensure that the radar boresight line and the pipper line-of-sight are parallel during the air-to-ground ranging mode.

e. The hand-set parameters on the WRCS cockpit panels and the screwdriver adjustments made to the computer must be accurate.

BALLISTIC COMPUTER, CP-805/ASQ-91

The ballistics computer (WRCS computer) is behind the rear cockpit, door 19. The WRCS computer contains all of the analog circuitry required to solve the bombing problem for each WRCS delivery mode. Built-in-test (BIT) features are incorporated to facilitate a go/no-go check of the WRCS.

The computer has several screwdriver adjustments (figure 1-20) under the dust cover plate that are made by the ground crew. These adjustments are bias factors and should not be confused with the actual parameter. For example: V_e IS NOT the ejection velocity of the bomb in feet per second; V_e is the ejection velocity bias factor that is selected and applied to the computer. The drag coefficient value (C_B which is dialed into the computer by the pilot) is also a bias factor that varies with the type of bomb and is related to a specific V_e bias setting. When V_e is changed, the drag coefficient must be changed.

WEAPONS RELEASE COMPUTER CONTROL PANEL

The weapons release computer control panel (WRCS panel) has three TARGET input controls, two RELEASE input controls, and a bomb DRAG COEFFICIENT input control. The panel also has a BIT control knob that is used to select and test the go/no-go status of the WRCS. (Refer to figure 1-22 WRCS manual inputs.)

Target Range Controls

The three target inputs are used for the target finding mode and the offset bombing mode. The distance between the IP (identification point) and the target is placed on the two distance readout displays by rotating the adjacent control knobs. The distance is manually placed on the readout control and is in hundreds-of-feet. The top target distance readout control receives the north or south distance; the lower target distance control receives the east or west target distance. For the offset bomb and target find mode, the altitude value placed in the ALT RANGE control should be either (1) the target or RIP elevation MSL ± the D value for the planned run in altitude or (2) the target or RIP pressure altitude. For the laydown bombing mode, the ALT RANGE readout control receives the range from the IP to target in hundreds-of-feet. Either the ALT or RANGE placard is illuminated under the panel, depending on the delivery mode selected (red for night lighting, white for day lighting). The maximum setting on the target controls is 999 X 100 feet (99,900 feet). Tick marks are provided on the 100-foot dial to permit intermediate settings.

The dual purpose ALT RANGE control has the following maximum settings: the maximum ALT setting is 100 X 100 feet (10,000 feet); the maximum RANGE setting is 249 X 100 feet (24,900 feet). The maximum setting on the N-S and E-W DISTANCE controls is 999 X 100 feet (99,900 feet).

CAUTION

> When a value is inserted on the target ALT RANGE counter other than 000, do not select the target finding or offset bombing mode unless; the aircraft altitude MSL is greater than the value (times 100) or, performing the target find/offset bomb WRCS BIT check as presented in section II. This is necessary to prevent possible damage to the pitch servo in the WRCS computer.

WRCS MANUAL INPUTS F-4D

DELIVERY MODE	TARGET – FT X100				DRAG COEF-FICIENT	RELEASE	
	N/S DIST	E/W DIST	ALT	RANGE		ADVANCE MILLI-SECOND	RANGE FT x 10 FT x 100
MAX SET	999	999	100	249	9.99	999	999
DIVE TOSS					X	X	
DIVE LAY						X	X
LAYDOWN				X		X	X
OFFSET BOMB	X	X	X			X	X
TGT FIND	X	X	X				
AGM-45			X			X	
TGT FIND/ LABS	X	X	X			X	X

4C-34-34-1-1-(25)

Figure 1-22

Release Range Control

The release range control knob is used to manually set the bomb range in tens-of-feet on the digital readout. This control is used for the laydown, dive laydown, and offset bombing modes. The maximum setting is 999 X 10 feet (9,990 feet) when the range switch on the weapon delivery panel is set on NORMAL. When the range switch is set on X100, the maximum setting is 999 X 100 feet (99,900 feet). Refer to LABS/WRCS Delivery Mode, Weapon Delivery Panel, this section.

Note

Do not set the target range control and release range control on equal values, allow at least 0.25 second time/distance between settings to allow for the maximum possible bomb rack time delay. If the values are equal, the bomb may not release or the bomb releases late.

Release Advance Control

The release advance control is operative in all WRCS bomb release modes and in the LABS/WRCS mode. The release advance control can be used in conjunction with the intervalometer on the station and weapon selection panel to advance the release signal in milliseconds. For example; if the BOMBS/TRIPLE mode is selected, with a release interval of 100 milliseconds (100 MS), the WRCS normally computes the release of the first bomb-on-target. The release advance control can be used to place the second bomb on-target by setting 100 milliseconds on the digital readout; the first bomb will then hit short of the target, the third bomb will hit long of the target. The counter has a maximum setting of 999 milliseconds. The release advance setting that will place the middle bomb on target can be determined by the following equation:

For an ODD number of bombs, to place the middle bomb on target:

$$RA = I_R \frac{(N - 1)}{2}$$

For an EVEN number of bombs, to place the FIRST middle bomb on target:

$$RA = I_R \frac{(N - 2)}{2}$$

For an EVEN number of bombs, to place the SECOND middle bomb on target:

$$RA = I_R \frac{(N)}{2}$$

where:

RA = Release Advance Setting in milliseconds.

I_R = Release Intervalometer setting in milliseconds.

N-1 = The number of bombs released minus one bomb.

Drag Coefficient Control

The drag coefficient control is used only during the dive toss mode. The maximum setting is 9.99. The drag coefficient (C_B) is a bias factor that is analytically established to equate the computer bomb trajectory to the actual bomb trajectory. This drag coefficient value is not the mathematical drag coefficient of the bomb. The drag coefficient values and bias settings are provided in section VI. The ground crew must set the Ballistic Computer (CP805/ASQ-91) in door 19. When V_e is changed, the drag coefficient will change.

Built-In-Test (BIT)

The built-in-test (BIT) control is used to establish the go/no-go status of the WRCS. The BIT selector knob is not a mode selector switch for computer operation. The BIT is initiated by rotating the knob to the bombing mode to be tested and depressing the button in the center of the selector knob, placarded PUSH FOR BIT, wait 5 seconds and then depress the FREEZE button while holding the BIT button depressed. Upon receiving either a Go or No-Go placard illumination, the BIT is discontinued by releasing the button. The NO-GO (amber) and GO (green) lights are located under the panel to illuminate the applicable placard. Illumination of the NO-GO indicator at times other than the BIT checks indicates an inertial navigation system malfunction. A NO GO indication will result if the BIT parameter (listed in the checklist) are not used. If a NO GO indication is received as the BIT button is released, the NO GO indication can be disregarded if a GO indication was previously obtained. Refer to section II, WRCS BIT check procedures.

CURSOR CONTROL PANEL

The cursor control panel (figure 1-21) contains the additional controls required to perform the target-finding mode and the offset bombing mode.

Cursor Controls

The cursor control panel has two thumbwheel type cursor controls (or slew controls) placarded ALONG TRACK and CROSS TRACK. These controls are used to position the cursors that appear on the AN/APQ-109 radar scopes when operated in the MAP-PPI mode. The controls are spring-loaded to return to the center position after each operation of the control; this return motion of the control does not affect the position of the radar cursors. The along track control contains a microswitch that activates a relay to enable the cursor control commands to be received by the WRCS computer. Therefore, the along track control must be moved first, and then the cross track control. Until the along track control is moved, or the FREEZE button is depressed, the velocity integrators in the WRCS computer are maintained at zero distance traveled. The along track control positions the range cursor over or below the RIP radar return. The cross track control positions the vertical offset cursor over the RIP radar return. The intensity of the cursors on the scopes can be controlled by

the controls located on scope panel in the rear cockpit. If the cursors appear to be erratic in track or control, push the reset button and resume operation.

Note

Do not position the range cursor below zero range. If the range cursor is moved below zero range and positioned over the IP, the steering information is in error by 180° and the cursor responds opposite to along track cursor control movements.

Freeze Button

When the FREEZE button is energized, the velocity integrators in the WRCS computer begin to calculate the distance traveled from zero, and the cursors begin tracking the ground position indicated on the radar scopes by the intersection of the two cursors. The freeze button remains illuminated until the reset button is depressed, or until a different delivery mode is selected. The freeze button is also used during the BIT check to initiate the test problem for all bombing modes.

Target Insert Button

When the TARGET INSERT button is energized, the north-south and east-west distances (entered in the WRCS panel controls) are inserted into the WRCS computer. This action causes the cursors to move from the RIP to the target and begin tracking the target location on the radar scope. Only at this point is target steering information supplied to the various display instruments. The target insert button remains illuminated until the reset button is depressed, or until a different delivery mode is selected.

Reset Button

The reset button is a momentary pushbutton switch spring-loaded to ON. Depressing the reset button deenergizes the tracking relays and cause the velocity integrators to return to zero distance traveled; the freeze button light and the target insert button light go out; the offset cursor on the radar scope moves to the center of the scope; the range cursor disappears. The purpose of the reset button is to permit the aircrew to cancel all previous inputs and start over. This might be desirable when the RIP can be visually located and a flyover fix on the RIP accomplished. When the aircraft is directly over the RIP, the pilot pushes the freeze button to energize the velocity integrators. If immediate steering information is required, the pilot should depress the target insert button as soon as possible after depressing the freeze button.

LEAD COMPUTING OPTICAL SIGHT

The lead computing optical sight AN/ASG-22 (figure 1-17) is used to establish a visual sight reference for air-to-air and air-to-ground weapons delivery. The sight unit is mounted on the front cockpit radar scope. A red reticle image is projected on a combining glass to serve as the visual sight reference. The sight can be depressed vertically from zero mils to 245 mils below the fuselage reference line. The sight is depressed by rotating the reticle depressing knob until the digital readout (in one-mil increments) corresponds to the desired sight setting. The sight cannot be manually positioned in azimuth.

Power is applied to the lead computing sight components and the gyroscope when the sight mode selector knob is in any position except OFF. In STBY, the sight reticle is mechanically caged, but not illuminated. In CAGE, the sight reticle is illuminated and mechanically caged to the radar boresight line. The radar boresight line is located 35 mils below the fuselage reference line; therefore, the optical sight setting is 35 mils, regardless of the reticle depression knob setting. The optical sight is mechanically caged when the sight mode selector knob is positioned to OFF, STBY, or CAGE. The optical sight has two modes of operation that are selected by the position of the mode selector knob located on the front cockpit scope panel: A/G (air-to-ground) and A/A (air-to-air). Variations of the two basic modes are controlled by the position of the weapon selector knob on the pedestal panel and the position of the selector knob on the delivery mode selector panel. Refer to figure 1-23 for the description of the optical sight functions with the various delivery modes, and refer to F-4D Weapon Delivery Modes, this section.

The reticle image that is projected on the combining glass is composed of a fixed reticle, roll reference tabs, and a range bar (figure 1-24). The fixed reticle consists of a two-mil diameter pipper located in the center of a 25-mil diameter segmented circle, and a 50-mil diameter complete circle. The 50-mile circle has three index tabs located on the outer edge at the top, and left and right of the pipper.

The roll reference tabs rotate about the 50-mil circle. The roll reference tabs have two separate functions. During the offset bombing mode and the target finding mode, the roll tabs provide steering information supplied by the WRCS. The position of the roll tabs, with respect to the fixed index tabs, indicates the angle between the ground track and course to the target. During all other modes of operation, the roll tabs indicate the aircraft roll attitude which is supplied by the INS.

The sight reticle flashes on and off to indicate a malfunction in the INS. When the INS is malfunctioned, the weapon release computer is inoperative. If the INS is inoperative, the DIRECT bombing mode should be used. The sight will also flash when the bomb release button is released prior to bomb release, indicating an aborted run or no WRCS solution. The bomb button cannot be re-depressed to continue the bomb run - the bomb run is aborted, except for the offset bombing mode. The only requirement for the offset bombing mode is that the bomb button be depressed at the time the bomb release signal is generated.

OPTICAL SIGHT FUNCTIONS F-4D

DESIRED DELIVERY	WEAPON SELECTOR KNOB	DELIVERY MODE SELECTOR (5)	SIGHT MODE SELECTOR KNOB	OPTICAL SIGHT RETICLE			
				ELEVATION	AZIMUTH	ROLL TABS	RANGE BAR
Guns A/A	GUNS	(1) NA	A/A	Lead Compute	Lead Compute	Roll	Max Range 6700 ft
Guns A/G	GUNS	OFF or DIRECT	A/G	Manual Dep. from FRL	Caged at 0°	Roll	
Rockets	RKTS & DISP	(4) DIRECT	A/G	Manual Dep. from FRL	Caged at 0°	Roll	
Tgt. Find	(7) NA	TGT FIND	A/G	Caged at RBL	Caged at 0°	(2)	
Dive Toss	(7) NA	DIVE TOSS	A/G	Caged at RBL	Drift	Roll	
Dive Laydown	(7) NA	DIVE LAY	A/G	Caged at RBL	Drift	Roll	
Laydown	(7) NA	LAYDOWN	A/G	(3)	Drift	Roll	
Offset Bomb	(7) NA	OFFSET BOMB	A/G	Caged at RBL	Caged at 0°	(2)	Max Range 6700 ft (*20,000 feet).
LABS Bombing	(7) NA	TIMED LEVEL, TIMED LADD, TIMED O/S, LOFT, or INST O/S	A/G	(3)	Caged at 0°	Roll	
Direct Bombing	BOMBS or RKTS & DISP	DIRECT	A/G	Manual Dep. from FRL	Caged at 0°	Roll	
AGM-12 or AGM-62	AGM-12 or AGM-62	DIRECT	A/G	Manual Dep. from FRL	Caged at 0°	Roll	
AGM-45	AGM-45	AGM-45	A/G	Caged at RBL	Caged at 0°	Roll	
Missiles Air-to-Air	(8)	(6) OFF	A/A	Caged at RBL	Caged at 0°	Roll	

RBL = Radar Boresight Line   FRL = Fuselage Reference Line.   NA = Not Applicable.

(1) The lead computing function of the optical sight reticle is not altered by the delivery mode selector panel section, nor by the selection of GUNS & STORES. The master arm switch must be in ARM. (*When the ARR button is held depressed, the lead angle computer receives a fixed 1500–foot range signal; the range bar continues to indicate the actual slant range, or maximum displayable range of 6700 feet.)

(2) The roll tabs display roll attitude until Target Insert, then the roll tabs display steering commands to the target.

(3) The sight reticle is pitch stabilized; manual depression is from the level plane (the local horizontal). If INS fails, sight depression will be in error by the amount of the pitch angle at the time of INS failure.

(4) Only DIRECT position can be used to fire rockets.

(5) The function of the optical sight depends upon the delivery mode selector panel selection (except for GUNS).

(6) The OFF position should be selected; however AIM missiles can be launched with any position selected except LABS. The function of the optical sight is not affected when air-to-air mode is selected.

(7) If weapon selector knob is in GUNS, the sight functions as a combination of the delivery mode selected and GUNS A/G.

(8) If GUNS (or GUNS & STORES) is selected, the master arm switch must be in SAFE to launch air-to-air missiles.

* T.O. 1F–4D–514

4C–34–1–1–(26)

Figure 1-23

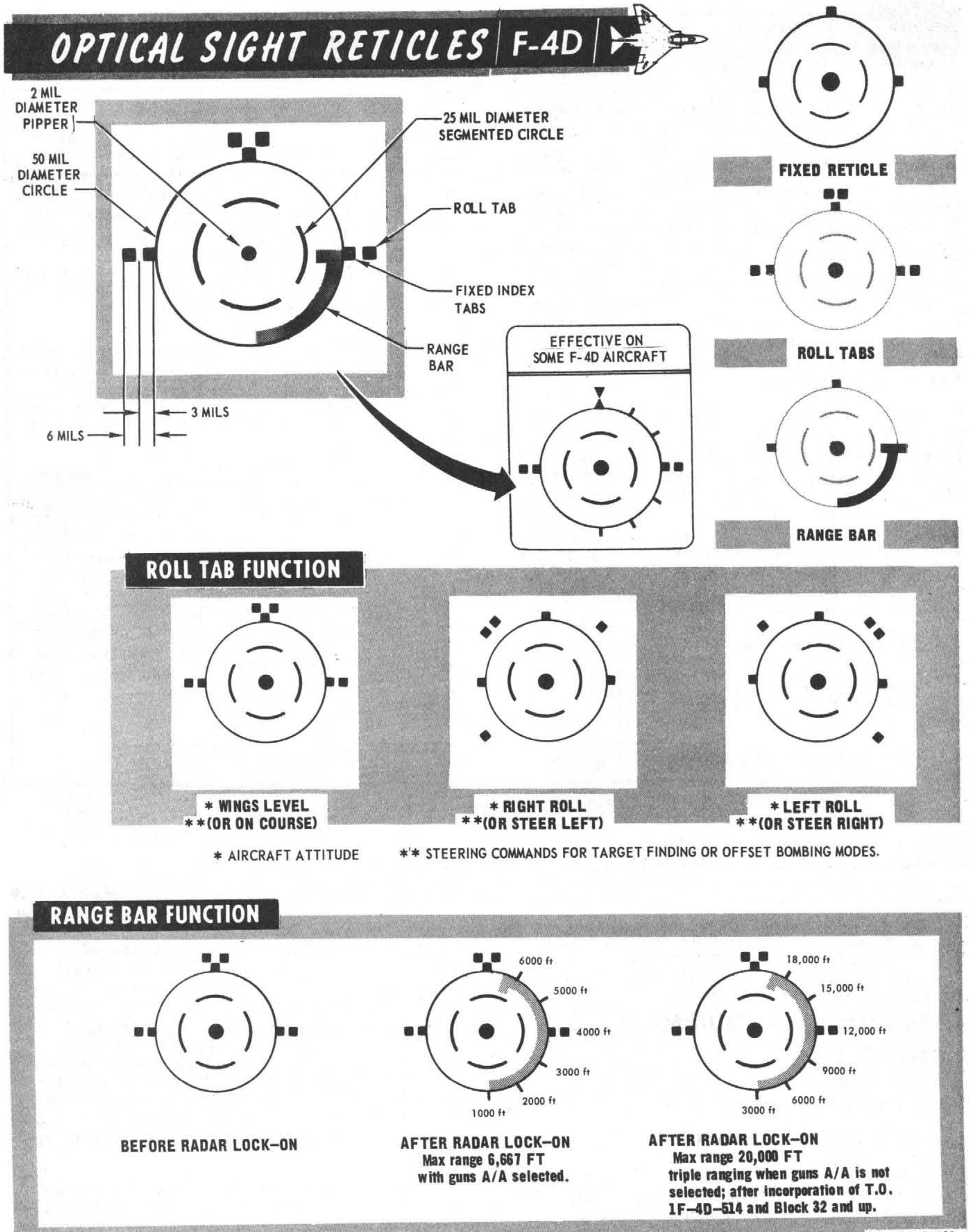

OPTICAL SIGHT RETICLES
F-4D
2 MIL DIAMETER PIPPER
50 MIL DIAMETER CIRCLE
25 MIL DIAMETER SEGMENTED CIRCLE
ROLL TAB
FIXED INDEX TABS
RANGE BAR
3 MILS
6 MILS
EFFECTIVE ON SOME F-4D AIRCRAFT
FIXED RETICLE
ROLL TABS
RANGE BAR
ROLL TAB FUNCTION
* WINGS LEVEL
* *(OR ON COURSE)
* RIGHT ROLL
* *(OR STEER LEFT)
* LEFT ROLL
* *(OR STEER RIGHT)
* AIRCRAFT ATTITUDE
** STEERING COMMANDS FOR TARGET FINDING OR OFFSET BOMBING MODES.
RANGE BAR FUNCTION
6000 ft
5000 ft
4000 ft
3000 ft
2000 ft
1000 ft
18,000 ft
15,000 ft
12,000 ft
9000 ft
6000 ft
3000 ft
BEFORE RADAR LOCK-ON
AFTER RADAR LOCK-ON
Max range 6,667 FT
with guns A/A selected.
AFTER RADAR LOCK-ON
Max range 20,000 FT
triple ranging when guns A/A is not selected; after incorporation of T.O. 1F-4D-514 and Block 32 and up.
F4D-34-1-212

Figure 1-24

The range bar is semi-circular and appears on the inside of the 50-mil circle only when a target has been acquired by radar lock-on. The instantaneous length of the range bar, and the rate at which the length is changing indicates the actual radar slant range and the range rate between the aircraft and the target. The length of the range bar can be 170°, beginning at the 6 o'clock position. When the inside tab on the range bar is at the 6 o'clock position, the actual radar range is 1000 feet. When the range bar tab is at the 5 o'clock position the range is 2000 feet. The range indication is linear; i.e., 1000 feet per each number on the face of a clock. When the range bar reaches its maximum length, (near the 12 o'clock position), the radar range is 6667 feet. If the range is greater than 6667 feet, the range bar will remain at the maximum position. Refer to Range Bar Triple Ranging. The range bar appears on the sight reticle to indicate the slant range to the target when radar lock-on is accomplished:

a. With the mode switch in A/A, the range bar appears when radar lock-on is accomplished in any of the radar modes and indicates slant range to the target for air-to-air gunnery and air-to-air missile attack. (Refer to Air-to-Air Gunnery.)
b. With the mode switch in A/G and the DIVE TOSS or DIVE LAY mode selected on the delivery mode selector panel, the range bar will appear to indicate radar lock-on has been accomplished in any of the radar modes and will indicate slant range from the aircraft to the position of the pipper on the ground.

RETICLE CAGING MODE
(AFTER T.O. 1F-4D-514).

In the guns lead compute mode of the optical sight, the ARR button may be depressed to energize a reticle stiffness relay in the computing amplifier (figure 1-25). With radar lockon, the sight reticle moves in azimuth and elevation to display the lead angle required. Before radar lockon a pseudo-range of 1500 feet is supplied to the lead angle computer; the range bar is not displayed. After radar lockon, the actual slant range to the target is supplied to the computer and displayed by the range bar. When lockon is accomplished out of gun range, the sight reticle may be over sensitive due to the range, high G forces and/or constant maneuvering flight. The sensitivity of the reticle can be reduced by depressing and holding the ARR button. When the ARR button is held depressed, the lead angle computer receives a fixed 1500-foot range signal; the range bar continues to indicate the actual slant range or the maximum displayable range of 6700 feet. When the trigger transfer relay is energized by selecting guns, the function of the ARR button is also transferred to provide reticle caging. The missile arm switch and missile select switch may be in any position; the AIM-4D coolant supply is not activated.

RANGE BAR TRIPLE RANGING

Interpretation of the slant range displayed by the position (or length) of the range bar is affected only when guns air-to-air is selected. With GUNS A/A selected, the minimum length of the range bar represents 1000 feet and the maximum length represents 6667 feet (approximately 6700 ft). When any other weapon or delivery mode is selected, the minimum length of the range bar represents 3000 and the maximum length represents 20,000 feet.

LOFT BOMBING EQUIPMENT CONTROLS

The loft bombing delivery mode utilizes the following controls and indicators (figure 1-17).

a. Attitude director indicator (ADI).
b. Accelerometer.
c. Pullup light.
d. Bomb release angle computer (Low Angle).
e. Bombing timer (Pullup Timer).
f. Delivery mode selector knob.
g. Pedestal panel.
h. Bomb release button (pickle button).

The following describes the controls as they are utilized to perform the loft delivery mode. Only the function of the controls which have not been described elsewhere will be discussed here.

ATTITUDE DIRECTOR INDICATOR (ADI)

The ADI aids the AC in establishing and maintaining a constant G pullup maneuver. The pointers are programmed to move out of center when the aircraft is not following the programmed pullup profile of 4.0 G's obtained in 2 seconds and maintained thereafter, and a wings-level pullup. When the loft bombing mode is performed by using a pullup acceleration of 3.0 G's obtained in 2 seconds, the ADI should not be used; use the aircraft accelerometer.

During the loft bomb run with the bomb mode switch on LOFT, the vertical and horizontal pointers program the flight path. Prior to actuating the bomb button, the vertical needle is deflected out of view if the navigation function selector knob is in the ATT position.

When the bomb button is depressed, the vertical pointer centers — preventing the roll signal and indicating flight path deviations while the pullup timer is operating. At pullup, when the pullup timer is complete, the resolved yaw/roll signal is presented on the vertical pointer. If the pointer deflects to the right during the pullup, the AC rolls to the right—correcting into the pointer. The vertical director warning flag appears or disappears to indicate the degree of TACAN signal strength. Therefore, the appearance of the flag has no meaning with respect to the vertical pointer in a bombing mode.

Note

For LOFT mode of LABS delivery, the pedestal panel REJECT switch should be in DF REJ, or else the weapon selector must not be in the AGM-45 mode. This is necessary to get the ADI vertical pointer into the LOFT yaw/roll network.

The horizontal pointer is always deflected out of view unless the loft bomb run is in progress (bomb button depressed). The pointer indicates deviations in the 1.0 G flight path during the low level approach to the pullup point. When the pullup timer is complete, horizontal pointer movement represents error between the desired pullup G program and actual load factor which is measured by the accelerometer. Note that the system actually programs the proper G build-up rate, which means that if the AC increases G loading at the proper rate, the pointer will never move from the center of the sphere. The pointer continues showing error in the constant 4.0 G flight path until the AC releases the bomb button after final bomb release.

The ADI OFF flag comes into view if: (1) a system ac or dc power failure occurs; (2) there is excessive error in the roll and pitch signal sources of the gyroscope assembly; (3) an ADI failure, or an internal dc failure within the ADI occurs. The OFF flag indicates malfunctions of the ARBCS only, regardless of the mode the AC has selected (PRIM or STBY) on the compass control panel. If the gyro system fails in some manner (as suggested by conditions 1 and 2 above), the aircrew cannot expect to obtain an accurate bomb release angle, since release occurs through the ARBCS pitch following system.

BOMB RELEASE ANGLE COMPUTER

The release angle computer contains the high and low angle release switches, the drum shaft and yaw/roll resolver, and the drogue switch. The pitch inputs drive the drum shaft which actuates the high and low angle release switches. The yaw and roll inputs are resolved, as a function of pitch, and transmitted to the flight director bombing computer for use in the vertical director pointer network. The controls on the front of the computer are available in the rear cockpit. The Low Angle control may be set from 0° to 89.9°, and the High Angle control may be set from 70° to 179.9°. Only the Low Angle control is used for loft bombing.

WARNING

When the LABS release angle gyro is set greater than 169.0°, bomb release may occur at the pullup point when the bomb button is depressed (INST O/S) or at the completion of the Pull Up Bombing Timer (TIMED O/S).

FLIGHT DIRECTOR BOMBING COMPUTER

This unit develops dc voltages, which are proportional to yaw/roll and G error, for steering indications in the loft bombing maneuver. The unit also contains the tone generator which provides the warning and pullup tone in the head set. By removing a cover plate, controls are available to set tone level, roll sensitivity, yaw sensitivity, and pitch and G error sensitivity. The sensitivity controls govern the ADI horizontal and vertical pointer rate of deflection with respect to yaw/roll and G error signals. The flight director computer contains a roll cancel relay which is energized if roll error (yaw/heading change) exceeds 30° during the pullup flight path. With the roll cancel circuit energized, the release circuit cannot be energized and the bomb run is cancelled. To ready the system for another run, momentarily position the delivery mode selector knob out of the selected function then back to LOFT.

BOMBING TIMER (DUAL TIMER)

The dual timer controls include the pullup and release timer controls in the rear cockpit. The pullup timer may be set from 0 to 60 seconds and the release timer may be set from 0 to 30 seconds. Both timers are settable in increments of 0.1 seconds with 0.1 seconds as the minimum numerical setting. The setting references in the window do not move during the application of operate voltage in the bomb run. Completion of the pullup timer energizes relays which provide the various pullup signals and the pullup flight program. The timers are either motor driven or solid state. The motor driven timer receives 115 volt ac power; the solid state timer receives 28 volt dc. Timer excitation voltage is applied when the AC selects any LABS mode except DIRECT. Timer initiate (operate) voltage is applied, however, as a function of the specific mode selected. To demonstrate, the following list summarizes the timer operated versus the mode selected. (Operate voltage is applied by actuating the bomb button.)

a. LOFT, TIMED O/S-
   Operate voltage is applied only to the PULLUP timer, provided the timer is set to some value other than zero. The PULLUP timer must be set to some value to energize the ADI pullup flight path program.

b. TIMED LEVEL and TIMED LADD
   Operate voltage is applied to the PULLUP timer; then to RELEASE timer at the termination of the PULLUP timer countdown. For the LADD mode, the PULLUP timer must be set on some value to get the ADI pullup schedule; the RELEASE timer must be set to develop a bomb release signal.

c. INST O/S-
   Operate voltage is not applied to either timer.

d. Pullup Warning Tone-

   (1) Motor Driven Timer: For all modes in which the PULLUP timer is set, a 0.25 second warning tone pulse is initiated 1 second prior to PULLUP timer completion.

   (2) Solid State Timer: A warning tone pulse is not provided.

For LABS/WRCS modes of operation, the above information remains the same except that the timer operate signal is applied by a signal from the WRCS ACTIVATE circuits, rather than the bomb button. In all LABS/WRCS combined modes, a 0.375 second activate tone is applied at the ACTIVATE point.

Note

The pullup tone to the head set will transmit over the air unless the function selector knob on the communication control panel is placed in the STBY position, or the pullup tone cutoff switch is positioned to TONE OFF (refer to Pullup Tone Cutoff Switch).

WEAPON DELIVERY MODES (F-4D)

AIR-TO-AIR GUNNERY

The following aircraft equipment comprise the F-4D air-to-air gunnery capability:

a. SUU-16/A, -23A Gun Pod.
b. AN/ASG-22 Lead Computing Optical Sight System (LCOSS).

The aircraft systems listed below are electrically interfaced with the optical sight system in support of the air-to-air lead computing mode.

a. AN/ASN-63 Inertial Navigation Set.
b. A24G-34 Air Data Computer Set.
c. AN/APQ-109 Radar Set.

In the lead computing mode, the sight system solves for a predicted point of impact by developing a solution to the vector diagram shown in the upper part of figure 1-25. The solution is computed in terms of aircraft azimuth and elevation coordinates, not earth coordinates. The net az-el solution is a function of trajectory shift, gravity drop, and kinematic lead vectors. The resultant is the lead angle, which is the angle formed between the gun bore line and the pipper sight line with the pipper on target. The vectors are briefly defined below.

TRAJECTORY SHIFT

Trajectory shift occurs because the gun bore line and the aircraft flight path are not the same. The line of departure of the bullets therefore forms an intermediate path which is a function of the gun muzzle velocity vector, the aircraft flight path vector, and the included angle. Since trajectory shift lies in the pitch plane of the aircraft, the sight gyro system is calibrated (a fixed setting for each altitude and range) to correct for trajectory shift in the elevation network.

GRAVITY DROP

Gravity drop is a function of bullet time of flight and the force of gravity. A correction for gravity is also applied by a fixed calibration to circuits of the lead computing gyro. In maneuvering flight, the components of gravity lie in both the azimuth and elevation planes. Therefore, the calibration effects the az-el network.

KINEMATIC LEAD

The kinematic portion of the problem involves lead computations which compensate for the continuous change in position (or motion) between the target and the interceptor. This portion of the vector diagram lies in a plane which includes the velocity vector of the target and the position of the interceptor. The computation is a direct function of the motion of the interceptor in the pitch (elevation) and yaw (azimuth) planes. The az-el gyro output is in turn influenced in magnitude by radar range, air density, and acceleration signals (figure 1-25). Considering the flow diagram, the gyro magnet axis is fixed and lies parallel to the radar boresight line (RBL). In maneuvering flight, the magnet axis follows RBL while gyro resists any change in direction. Since the gyro dome rotates directly in the magnetic field, an increase or decrease in magnet current strength has a sensitivity (precession) effect on the position of the gyro. For example, an increase in magnet current strength - which occurs with a decrease in radar range - causes the gyro spin axis to precess and align more closely with magnet axis. The resultant gyro motion, which is transmitted to the optical sight reticle, becomes a reduction in the indicated azimuth and elevation lead as the aircraft closes with the target.

Compensations for acceleration are accomplished in a similar manner as described above. Current flow in the accelerometer network applies a restraining force to the gyro gimbal, which in turn causes the gyroscope to precess in elevation and increases gyro sensitivity. Hence, an increase in normal acceleration causes an increase in the indicated elevation lead angle.

To summarize optical sight lead functions, the azimuth-elevation lead computations are applied in terms of aircraft coordinates. Correction factors are applied to influence both the gyro azimuth and elevation output for range and air density. The elevation (pitch) output is influenced by normal acceleration from the accelerometer circuits. The net optical sight corrections are these plus the calibrations for gravity drop and trajectory shift.

As the flow diagram shows, the sight system provides lead data for the constant 1500 foot range when radar lockon is lost or when the AC actuates electrical cage. With radar lockon, range data is always available to the reticle range bar when range is within the limits of 900 and 6700 feet. However, the sight computes lead for a maximum range of 4000 feet. Roll reticle signals are applied directly from the INS gyro platform.

In a typical lead pursuit firing pass, the position of the pipper on the combining glass is of little importance while the aircraft is well outside the tracking range. For any one set of maneuvering conditions, the greater the range, the greater the instability of the sight reticle. Hence, the ARR button may be held depressed until the AC can reach a tracking range (4000 feet or less). The most important single factor which the AC must properly control is aircraft acceleration. As the AC tracks and pulls the pipper (from a point aft of the target) up into the target, acceleration build-up rate should be constant. Then the act of stabilizing the pipper on target is a matter of holding a G that has already been obtained, and for which the sight has already compensated.

The air-to-air gunnery mode is selected by placing the delivery mode selector knob to OFF (or as desired), the weapon selector knob on GUNS, and the optical sight mode knob on A/A. The radar is operated in the RDR or MAP-B modes and in the AI ranges (normally, R1) where lock-on and automatic tracking are possible. Prior to the attack, the guns and stores switch is in NORMAL, the guns AUTO-CLEAR or NONCLEAR position is selected, the applicable station selector buttons are pushed ON, and the master arm switch is placed to ARM. Both the green SELECTED light and amber READY light within the selector button must be illuminated before the guns can be fired.

The gun pod can be carried on the outboard armament pylons and on the centerline bomb rack. The gun pods are boresighted along the fuselage reference line and harmonized to converge at 2250 feet. The specified accuracy of the SUU-16/A -23/A gun pod with the M61A1 gun is 80 percent dispersion within an 8 mil cone. Part IV illustrates the harmonization range and dispersion cone for 80 percent of the rounds fired at minimum and maximum range.

Note

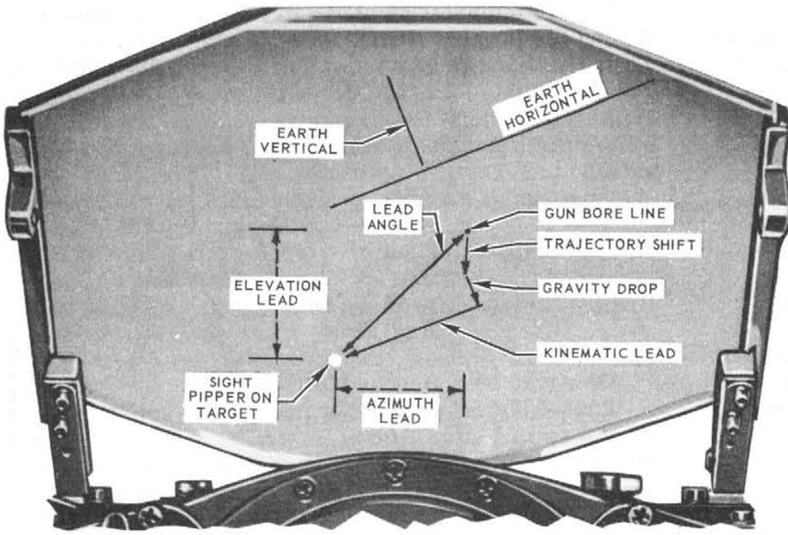
> Refer to Air Refueling Release (ARR) Button (reticle caging mode) and to Automatic Acquisition Switch, this section.

DIRECT DELIVERY MODE

When the DIRECT position on the delivery mode selector panel is selected, the bomb release button is in direct control of the bomb release relay. The DIRECT position must be used to fire rocket launchers. Depressing the bomb release button releases

OPTICAL SIGHT SIGNAL FLOW F-4D

AIR-TO-AIR MODE



Notes

1. GYRO MAGNET CURRENT STRENGTH IS A FUNCTION OF SUMMED RADAR RANGE AND AIR DENSITY SIGNAL INPUTS.
2. AZIMUTH LEAD OUTPUT IS A FUNCTION OF AIRCRAFT YAW RATE. THE MAGNITUDE OF AZIMUTH OUTPUT IS CONTROLLED BY MAGNET CURRENT STRENGTH.
3. ELEVATION LEAD OUTPUT IS A FUNCTION OF AIRCRAFT PITCH RATE. THE MAGNITUDE OF ELEVATION OUTPUT IS CONTROLLED BY ACCELEROMETER OUTPUT AND MAGNET CURRENT STRENGTH.

--- MECHANICAL CONNECTION
——► ELECTRICAL CONNECTION

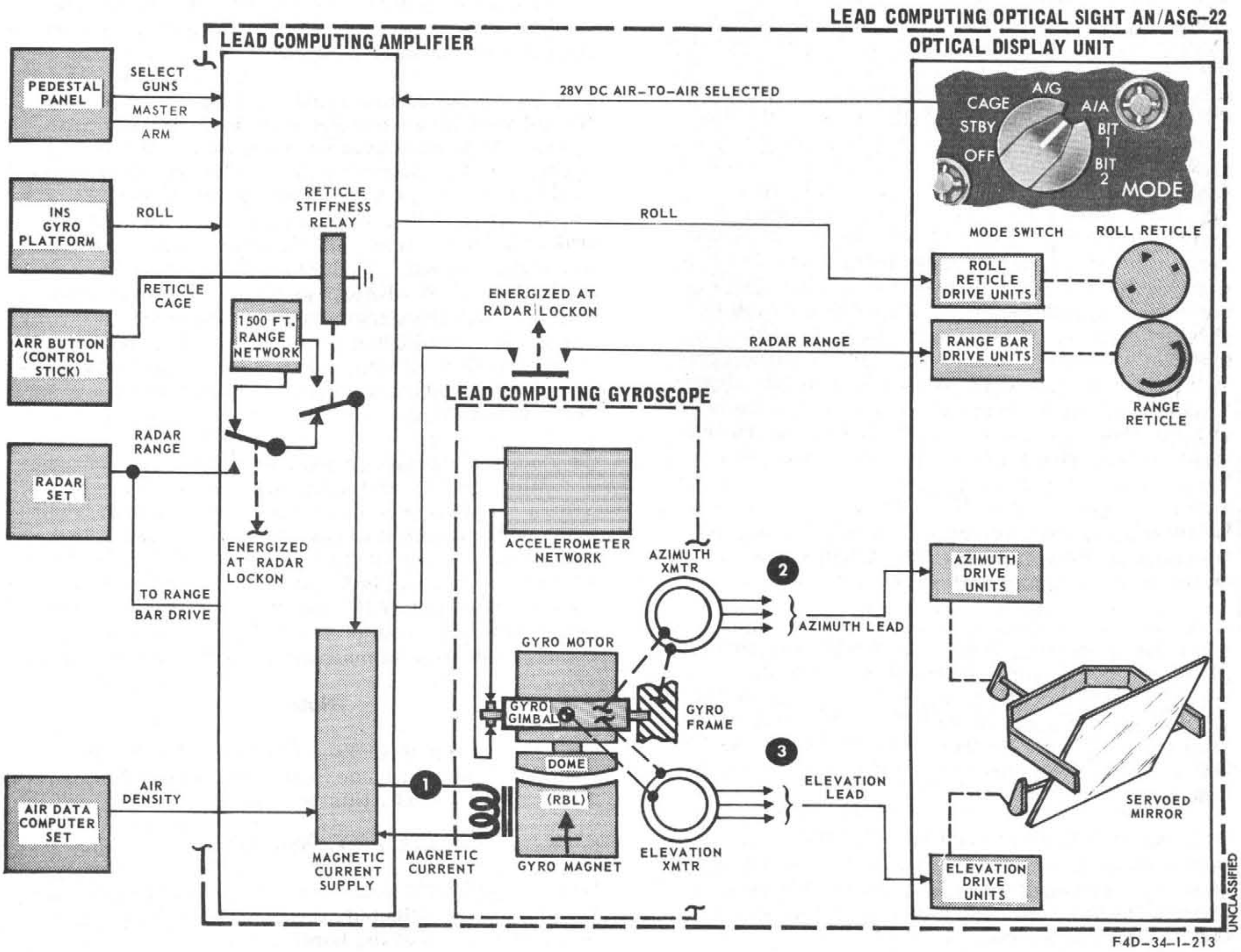


Figure 1-25

the bombs, fires rockets or launches the air-to-ground missiles from the selected stations. The direct delivery mode requires that the preplanned release parameters for the mission be established and controlled by the aircrew; the WRCS is not used. The air-to-ground mode of the optical sight establishes the bomb release point for a given release altitude, release airspeed, and dive angle.

DIVE TOSS BOMBING MODE

The WRCS dive toss bombing mode is a visual delivery mode used to deliver the low drag bombs. Since preplanned release parameters are not required, the target may be approached from any direction, airspeed, and dive angle. The bomb will be automatically released when the bomb trajectory intercepts the target. Figures 1-13 and 1-14 illustrate the various delivery maneuvers that can be used with the dive toss mode: dive-level, dive-glide, or dive-toss. This manual presently contains the data required (drag coefficients) to deliver bombs using the dive-toss bombing mode. Refer to section VI, Drag Coefficients.

The AN/APQ-109 radar set is operated in the AIR-GRD mode and in the R1 range to provide a drift stabilized, boresighted antenna. The radar supplies slant range information to the WRCS computer and the optical sight. The lead computing optical sight is used to visually establish a radar fix on the target. The sight is operated in the air-to-ground mode to provide roll reticle display and provide a sight reticle which is electrically caged in elevation to the radar boresight line (depressed 35 mils from the fuselage reference line) and drift stabilized in azimuth. The dive toss bombing mode is selected by placing the delivery mode selector knob to DIVE TOSS and positioning the weapon selector knob to BOMBS/RIPPLE, TRIPLE, or SINGLE. The only controls used on the WRCS panel are the drag coefficient control and, if required, the release advance control. Use of the R2 and R3 range is not recommended since the position of the ground return line sometimes causes inadvertent side lobe lockon.

Note

With the weapon selector knob in any position other than BOMBS-SINGLE, TRIPLE, or RIPPLE, the sight depresses according to MIL setting causing a gross error.

After the target area has been visually identified, the AC begins to dive toward the target. The slant range (roll in altitude) is normally 20 percent higher than it would be for direct dive delivery to allow time for the accomplishment of air-to-ground lock-on by the pilot. Target tracking is not required prior to radar lock-on, i.e., the objective is to maneuver the aircraft to obtain a strong ground return on the radar scope which the pilot will use to obtain a lock-on.

During the initial lock-on attempt, the all important factor in obtaining a lock-on that will hold until after PLMS and after depressing the bomb button, is a CONSTANT range rate. For example, constant range rate is attained when the dive angle is constant and there is no rapid movement of the nose attitude.

Lock-on is broken by a RAPID CHANGE in range rate. Lock-on can be obtained while inverted if the range rate can be maintained constant. However, a RAPID CHANGE in range rate during the roll-out may cause the radar to break lock-on; this is especially true prior to PLMS. After PLMS, the aircraft can be maneuvered with a higher range rate change without loosing lock. PLMS cannot occur until after the 2-second time delay has elapsed. The range strobe may wander up and down the clutter while seeking the center of the radar beam. The range strobe must be tracking at a constant rate before reliable slant range will be available when the AC depresses the bomb button. The 2-second time delay is initiated when range lock-on is obtained.

Note

On radar sets modified by T.O. 12P2-2APQ109-533, PLMS occurs approximately 0.5 second after lockon.

Lock-on should be monitored by the angle lock light if the manual V_c knob is pushed on to close the angle lock switch. The angle lock light illuminates immediately after range lock is obtained and goes out immediately when range lock (or angle lock) is broken, even when the range track circuit is operating on the 5-second memory circuit. The range bar and the lock-on display are retained during the memory time. The 5-second memory circuit is not available until after the 2-second time delay has elapsed; this will normally occur just prior to or at PLMS. If the system goes on memory, (angle lock light out) the pilot should break lock-on and reaccomplish lock-on while the range rate is constant. The bomb button should not be depressed while the system is on memory because the memory circuit may contain a rapid range rate that will drive the range gate toward zero slant range. This could cause the bomb to be released short of target; release might occur when the bomb button is depressed. After PLMS the aircraft can be maneuvered for the final phase of the dive toss delivery; mild changes in range rate should not cause the radar to break lock-on after PLMS has occurred. The pilot should observe the angle lock light is on to ensure that the memory tracking circuit is not being employed and inform the AC that a valid range lock is available.

The AC must maintain a constant range rate during the lock-on phase (prior to PLMS) and for at least 1-second prior to depressing the bomb release button. The bomb release button should not be depressed until after the pilot has confirmed a valid lock-on. The range rate can be observed by the movement of the pipper on the ground: the pipper should be moving toward the target at a constant rate. When the pipper is on target, the AC depresses the bomb button to insert the slant range between the aircraft and the target at that instant. After depressing the bomb button the AC begins desired delivery maneuver while maintaining a wings-level ground track that will pass through the target. Radar lock-on is not required after the bomb button is depressed since the slant range input is terminated when the bomb button is depressed.

Note

- To ensure that the bomb button is not depressed at the initiation of the pull-up maneuver (or dive maneuver), the AC should follow through after depressing the bomb button by maintaining the constant range rate for a short period after depressing the bomb button.
- If it is apparent that the drift stabilization portion of the sight is malfunctioning, a delivery can be accomplished with the sight caged and an estimated wind correction offset aimpoint used.

The radar range may be greater than the maximum range display capability of the range bar, thus, the maximum length of the range bar will be displayed. Observe the range bar for a false tracking indication. If a rapid decrease in range is displayed, the pilot may have locked on a radar side lobe rather than the main radar beam. Immediately request the pilot to break-lock for another attempt.

Regarding the dive toss bombing mode, the aircrew must consider the computer limitations. The bomb button signal may be delivered at a maximum slant ranges of 25, 000 feet, and at a maximum altitude of approximately 18, 000 feet AGL. A profile in section IV shows expected computer accuracy within these parameters. The profile considers only computer accuracy, and that computer inputs from all other systems are within specified limits.

After the bomb button is depressed, the AC begins the desired delivery maneuver: dive-level, dive-glide, or dive-toss. The vertical needle on the ADI will display deviations from the magnetic heading established at pickle. The dive-toss maneuver consists of a pullup maneuver (at the desired acceleration rate) that is initiated after depressing the bomb button. The climb angle must not be greater than 10° before release to ensure the accuracy of the bomb release point. The AC should strive for a straight-line ground track through the target. The roll tabs on the sight reticle will assist the AC in maintaining a wings-level dive and pullup. The bomb release button must be depressed (and held depressed until bomb release) when pipper is on or slowly passing through the target. The dive-glide maneuver consists of a shallow dive toward the target until bomb release occurs. For example: if the initial dive angle was 40° when the bomb button was depressed, the dive must be decreased by a minimum of 5° (40° -5° = 35°) for low drag bombs. If the initial dive was 30°, then the dive-glide maneuver must be a 20° dive or (30° -10° = 20°). The dive-level maneuver consists of a level flight approach toward the target until bomb release occurs. The dive-toss, dive-glide, and the dive-level maneuvers are illustrated in figure 1-26. The WRCS function and requirements are the same as for the dive toss maneuver. The requirements of the dive-glide and dive-level maneuvers are:

a. The bomb release button is normally depressed when the aircraft is at a greater slant range from the target than is required for the dive-toss maneuver.
b. The aircraft will maintain a wings-level flight (after depressing the bomb button) for a longer period than is required for the dive-toss maneuver.

When the AC depresses the bomb release button, the position and attitude of the aircraft, with respect to the target, is set into the weapons release computer. The slant range to the target, obtained by the AN/APQ-159 radar, is resolved with inputs from the INS to establish the ground range and altitude above the target. The weapons release computer begins to integrate ground speed and subtract the results from the initial ground range. Vertical velocity is also integrated and the results are subtracted from the initial altitude above target. The weapon release computer continuously monitors the aircraft altitude and ground speed and automatically supplies a release signal when the computer trajectory of the bomb intersects the target.

AIR-TO-GROUND LOCK-ON

The AIR-GRD radar mode is used only for the dive toss and dive laydown bombing modes. The purpose of the radar AIR-GRD mode is to establish the slant range to the target and route this range data to the WRCS. The WRCS then computes the position of the aircraft with respect to the target and automatically releases the bomb when the target is within bombing range.

Prior to the bombing run, the AC selects one of the dive delivery modes on the delivery mode selector panel, selects the A/G optical sight mode, and prepares the pedestal panel for a weapon release. The pilot places the radar power switch to OPR, the radar range switch to R1 and the radar mode switch to AIR-GRD. The radar antenna and the optical sight are now drift stabilized; the optical sight line is parallel with the radar boresight line (the centerline of the radar beam). The B-sweep (and range strobe) is offset from the center of the scope equal to the drift angle.

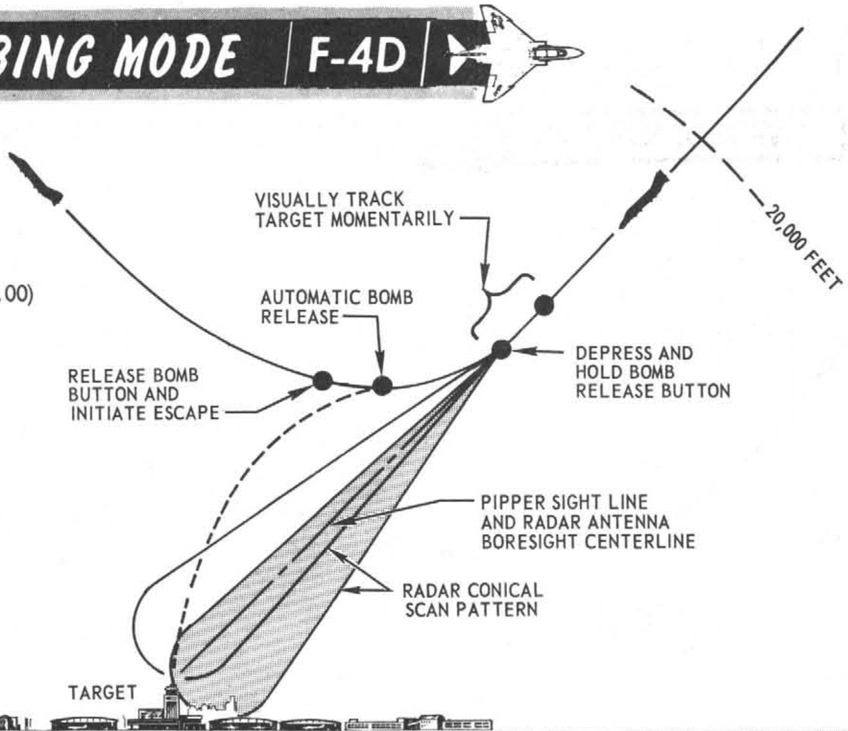
DIVE TOSS BOMBING MODE F-4D

OPTICAL SIGHT:
1. Drift Stabilized
2. Reticle caged to the radar boresight line.

WRCS Manual Inputs:
1. Drag coefficient (not set less than 1.00)
2. Release Advance.

AN/APQ-109 MODE:
1. A/G
2. R1 or R2 Range

INS Supplies:
1. Groundspeed
2. Pitch Angle
3. Vertical Velocity



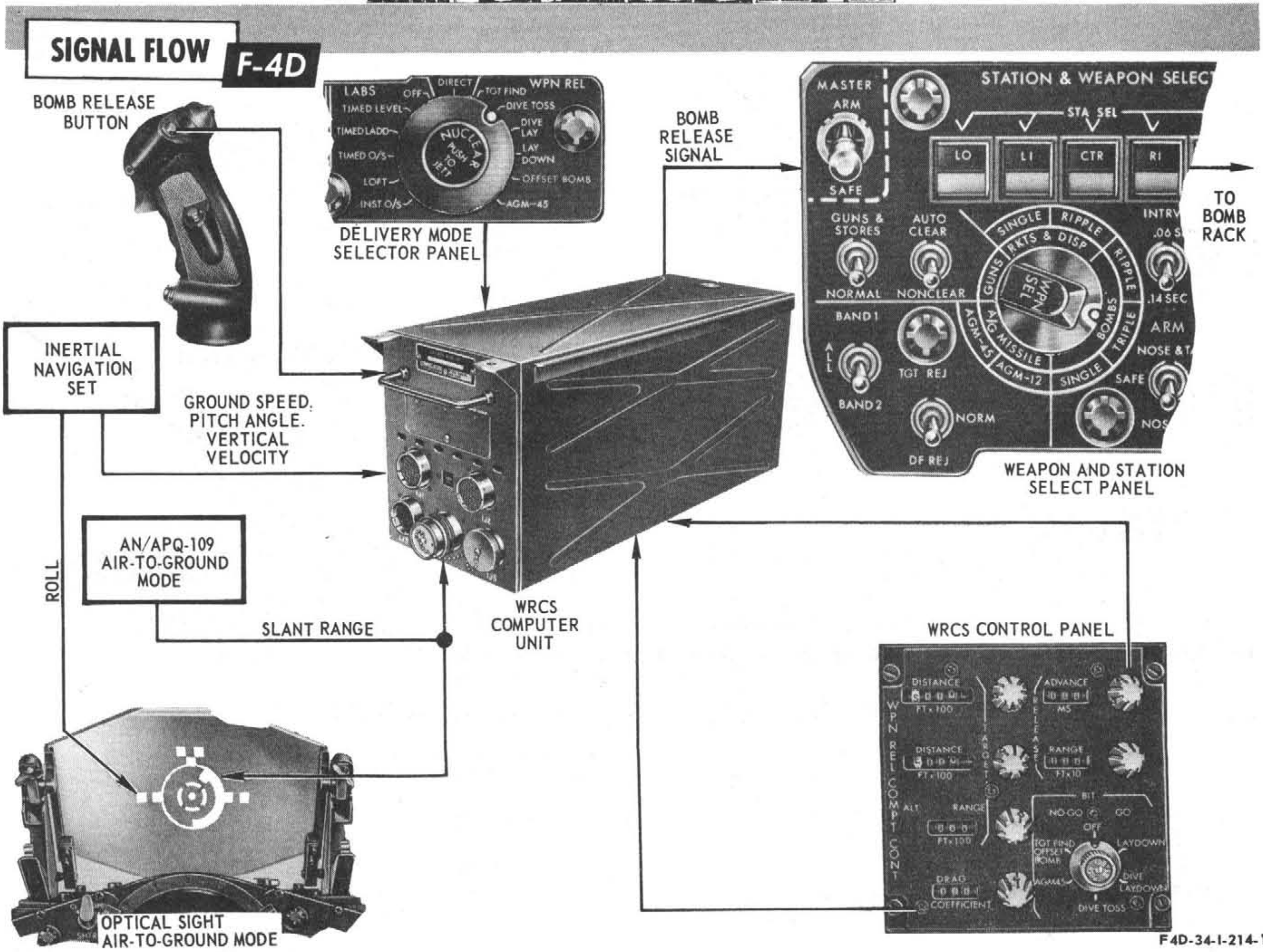
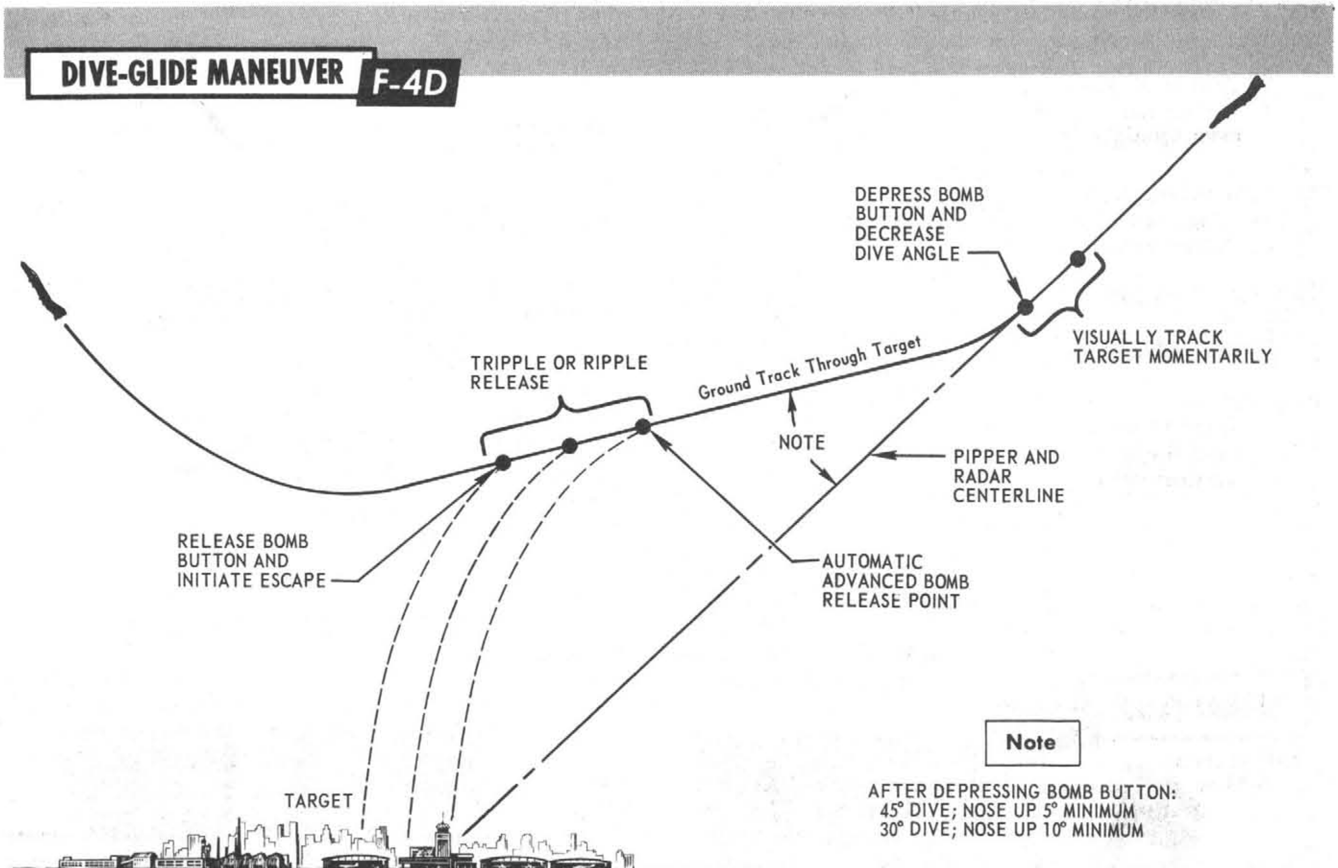


Figure 1-26 (Sheet 1 of 2)



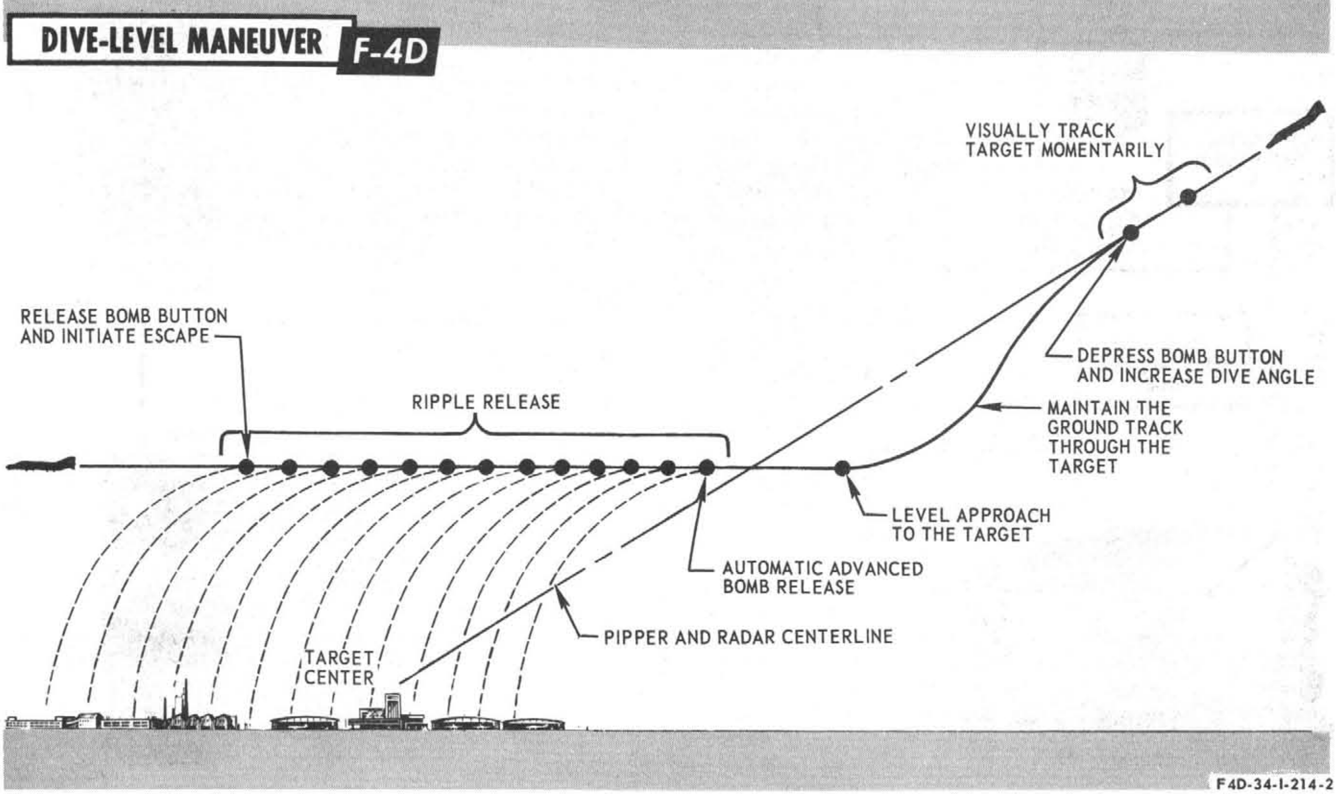


Figure 1-26 (Sheet 2 of 2)

After the target area has been visually identified, the AC begins to dive toward the target. When the dive angle is established and the range rate is relatively constant, the pilot may begin the air-to-ground lock-on procedure. The receiver gain is reduced to eliminate the radar side lobe return, thereby eliminating the altitude line displayed on the B-sweep. The gain should be reduced until the length of the ground return in the B-sweep is as short as possible before the return begins to break up and fade. The fine adjustment knob on the receiver gain control will aid the pilot in this task. The actual length of the return is a function of the antenna graze angle (aircraft dive angle) and the amount of receiver gain. For a 25° dive angle, the main beam clutter band can be reduced to approximately 1/2-mile long. The clutter band is longer for the lower dive angles. The center of the main beam clutter band displayed on the scope is the point on the ground receiving the highest concentration of energy - the center of the radar beam. This is also the point on the ground seen by the AC through the optical sight pipper position.

Adjust the receiver gain until the smallest amount of clutter is present. The acquisition symbol should be positioned at approximately 4 miles and lock-on should not be attempted until the clutter is in this area. Then depress the action switch to Half-Action. The range strobe will then appear between the acquisition symbol. Slant range is supplied to the computer when the range strobe is on the scope. Move the hand control to position the range strobe directly in the center of the main beam clutter band; then depress the action switch to Full-Action to obtain radar lock-on.

After lock-on, range tracking is announced by the appearance of the ASE circle on both scopes, illumination of the angle lock light, and the appearance of the range bar on the sight reticle; the acquisition symbol is removed. Approximately 2 seconds after lock-on, power level mode switching (PLMS) occurs; the ground return is sharply reduced allowing only the range strobe to appear. The slant range input is more accurate after PLMS.

Note

The lock-on should not be considered valid until after PLMS and the range tracking circuit is not operating on memory.

Slant range can be interpolated by the vertical position of the range strobe which moves down the B-sweep display as the slant range to the target decreases. The ASE circle remains in the center of the scope and fixed in diameter.

Another consideration to ensure bombing accuracy is the stability of the range strobe. The range strobe may wander up and down after lock-on for 2 to 3 seconds prior to power level mode switching (PLMS). The range strobe must be steady before reliable slant range is available when AC depresses the bomb button. Bombing accuracy is also affected by long slant ranges and by high G acceleration during pull-up after pickle. After T.O. 1F-4D-507, the computer accuracy increases by adding a vertical velocity acceleration compensator. This influences the release point computation in the vertical plane.

Range tracking of the ground return can be rejected by depressing the action switch momentarily to Half-Action. Lock-on can also be broken by a nose-up maneuver where the range rate is increased beyond the range tracking capability of the radar. In this case, tracking continues on memory for 5 seconds. If the ground return signal reappears within 5 seconds, normal tracking is automatically resumed if the position of the ground return coincides with the position of the range strobe. When lock-on is broken, the ASE circle and the range strobe is removed from the display and the acquisition symbol reappears. Refer to T.O. 1F-4C-34-1-1A for the classified description of the Air-to-Ground Mode.

DIVE LAYDOWN BOMBING MODE

The dive laydown bombing mode is illustrated in figure 1-27. The dive laydown bombing mode is essentially the same as the dive toss bombing mode (dive-level maneuver) with the following exceptions for the dive laydown mode:

a. The dive laydown bombing mode is used primarily for the delivery of high drag weapons (CBU-1, CBU-2, Snakeye I, etc.) where bomb range is relatively insensitive to deviations from the preplanned release parameters.

b. The bomb range is manually set in the Release Range control on the WRCS panel; the Drag Coefficient control is not used.

c. The AC must fly the preplanned released true airspeed (or ground speed) and the preplanned release height above target that will produce the bomb range set in the Release Range control.

The dive laydown bombing mode is selected by placing the delivery mode selector knob to DIVE LAY and positioning the weapons selector knob to either RKTS & DISP (for dispensers only) or BOMBS. The only controls used on the WRCS panel are the release range control and, if required, the release advance control. The value placed on the release range control is the horizontal bomb range for a given release altitude above target AGL and release true airspeed obtained from the bombing tables.

The initial portion of the delivery prior to depressing the bomb button is identical to the dive toss-bombing mode, refer to dive toss bombing mode, this section. Depressing the bomb button causes the AN/APQ-109 radar to supply slant range to the WRCS computer and causes the INS to supply groundspeed and pitch

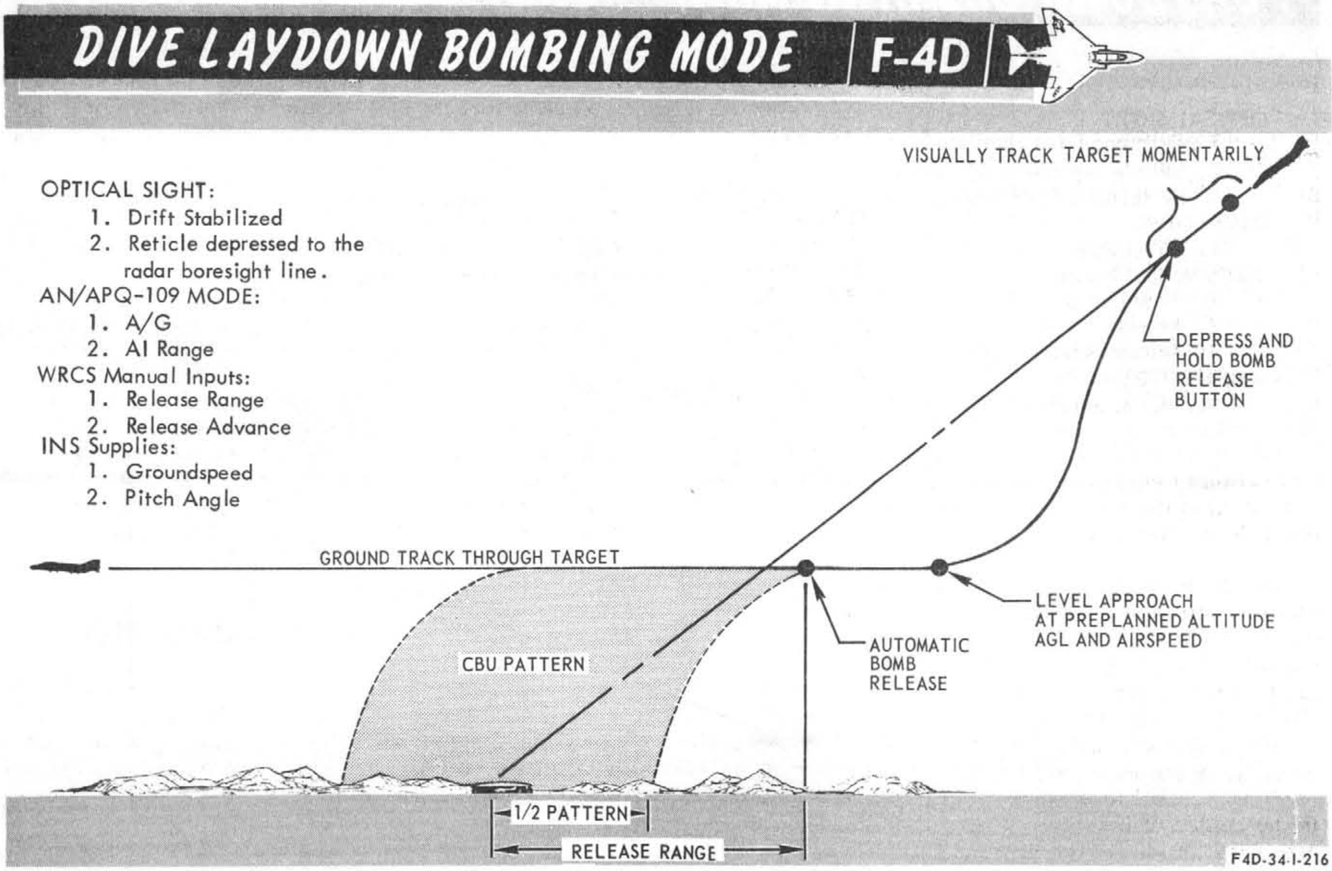


Figure 1-27

angle to the WRCS computer. These inputs are used to compute the horizontal distance to the target. The WRCS computer continues to monitor the horizontal range to the target with respect to the initial range established when the bomb button was depressed. When the aircraft is at the release range from the target set in the release range control, the WRCS automatically supplies a release signal to the weapons release circuits.

After the bomb button is depressed, the AC may increase the dive angle to arrive at a preplanned approach altitude AGL. The final approach to the target is made at the preplanned airspeed and altitude above target.

LAYDOWN BOMBING MODE

The laydown bombing mode (figure 1-28) is used for delivery of high drag weapons where the bomb range is relatively insensitive to variations in preplanned release conditions. The maneuver consists of a low level approach and delivery at a preplanned release altitude AGL and at a preplanned airspeed. The AN/APQ-109 radar is not employed by the laydown bombing mode. The lead computing optical sight can be used, or an IP can be used, to establish a known aircraft-to-target distance. The lead computing optical sight is operated in the A/G mode. With the laydown bombing mode selected, the reticle image will be pitch stabilized with reference to the horizontal plane of the inertial platform and drift stabilized along the ground track. The reticle depression is controlled by the reticle depression knob.

During mission planning, a desirable sight depression angle for the planned release altitude is chosen from the sight depression chart; (do not add fuselage angle of attack) the resulting range from the aircraft to target is established and entered in the target range control (placarded ALT RANGE) on the WRCS panel. The horizontal bomb range for the selected release altitude and airspeed is obtained from the bombing table and entered in the release range control on the WRCS panel. For the CBU delivery, or a ripple release, one-half of the pattern length may be added to the value placed in the range control, thereby, placing the center of impact on-target.

LAYDOWN BOMBING MODE F-4D

OPTICAL SIGHT:
1. Drift and Pitch Stabilized
2. Reticle depression controlled by RETICLE DEPR knob.

INS Supplies:
1. Groundspeed

WRCS Manual Inputs:
1. Target Range
2. Release Range
3. Release Advance

AN/APQ-109 MODE:
1. Not Required.

Note

An IP may be used to establish the target range if the optical sight is not used.

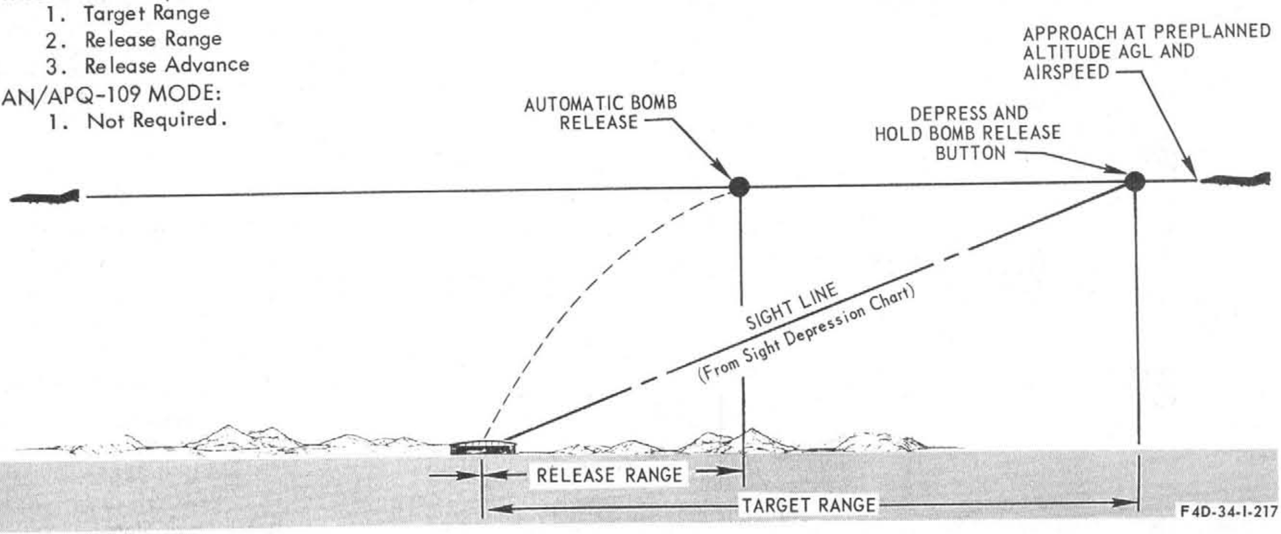


Figure 1-28

CAUTION

When a value is inserted on the target alt range counter other than 000, do not select the target finding or offset bombing mode unless: the aircraft altitude MSL is greater than the value (times 100) or, performing the target find/offset bomb WRCS BIT check as presented in section II. This is necessary to prevent possible damage to the pitch servo in the WRCS computer.

The approach to the target is made at the preplanned altitude above target and preplanned true airspeed (or a ground-speed that will produce the established bomb range). When the pipper is on-target, the bomb button is depressed and held until bomb release. When the bomb button is depressed, the aircraft will be at the distance from target set in the target range control, the INS begins to supply ground-speed data to the weapons release computer, and the ground-speed data is integrated with time by the computer to establish the distance traveled from the point. When the aircraft has traveled the distance entered in the target range control minus the value set in the release range control, a bomb release signal is generated and routed to the release circuit to initiate a bomb release.

The laydown bombing mode is selected by placing the delivery mode selector knob to LAYDOWN and positioning the weapons selector knob on RKTS & DISP or BOMBS. On the WRCS panel, enter the preplanned values in the target range control (the range light under the ALT RANGE placard will illuminate when LAYDOWN is selected) and the release range control. The release advance control may also be used, if necessary.

OFFSET BOMBING MODE

The offset bombing mode (figure 1-30) provides the aircraft with an all weather (blind bombing), high and low altitude, level bombing capability. The offset bombing mode requires an IP to establish the position of the aircraft with respect to the target. After the aircraft position is supplied to the WRCS computer, steering information is presented to the aircrew. The navigation range from this point to bomb release can be from 500 to 180,000 feet. When the aircraft is at the preset release range from the target, the bomb is automatically released. To provide an IFR capability, either the target or the IP must be radar definable. A radar definable IP is referred to as a radar IP (RIP). To provide a VFR capability, a prominent visual IP (VIP) must be used. The RIP can be beyond the target or offset from the approach course to the target — RIP-flyover is not required.

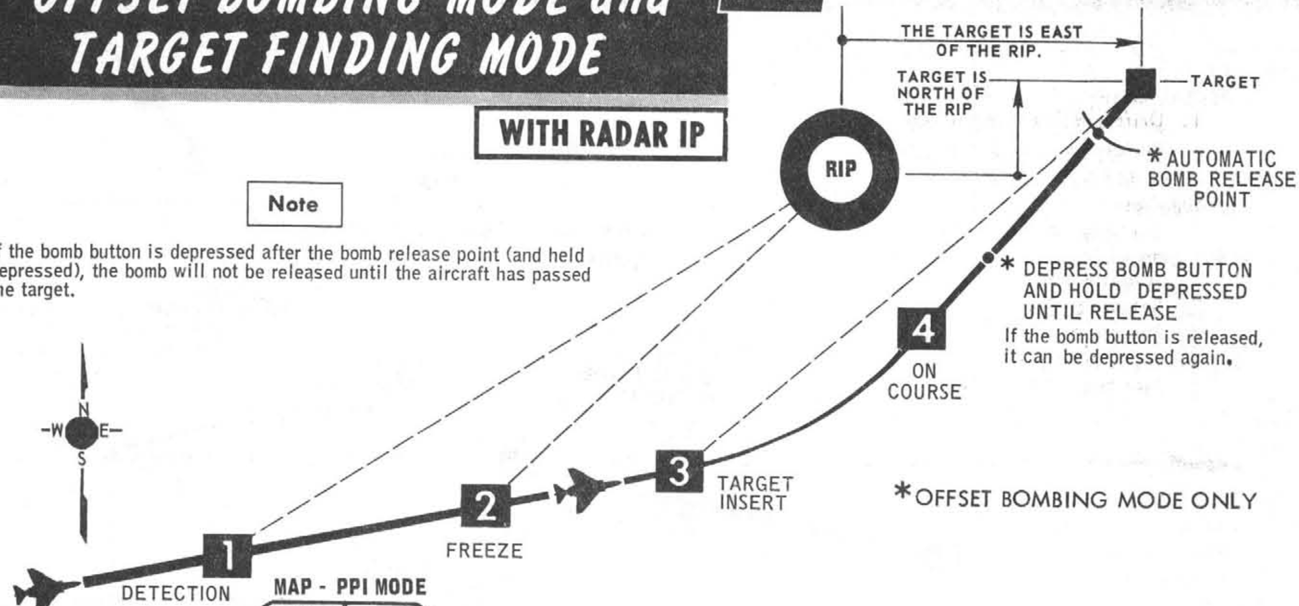
OFFSET BOMBING MODE and TARGET FINDING MODE

F-4D

WITH RADAR IP

Note

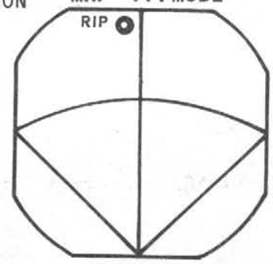
If the bomb button is depressed after the bomb release point (and held depressed), the bomb will not be released until the aircraft has passed the target.



MAP - PPI MODE

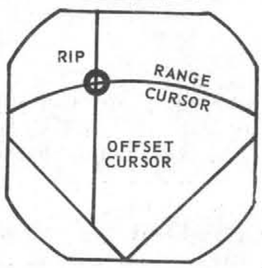
1

Pilot Detects RIP Return on Radar Scope



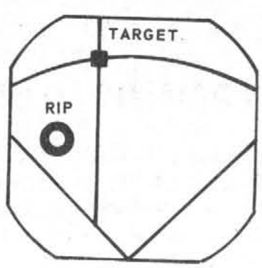
2

Pilot Places Cursors Over the RIP and Depresses the Freeze Button.



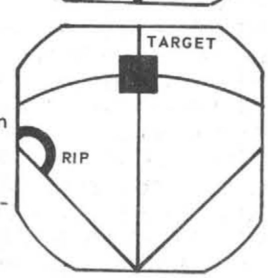
3

Pilot Depresses Target Insert Button. AC Receives Range and Steering Display and Maneuvers to Target.



4

Maneuver Toward the Indicator and Arrive on Course to the Target. NOTE: The Optical Sight is not Drift Stabilized. PPI display is Drift Stabilized.



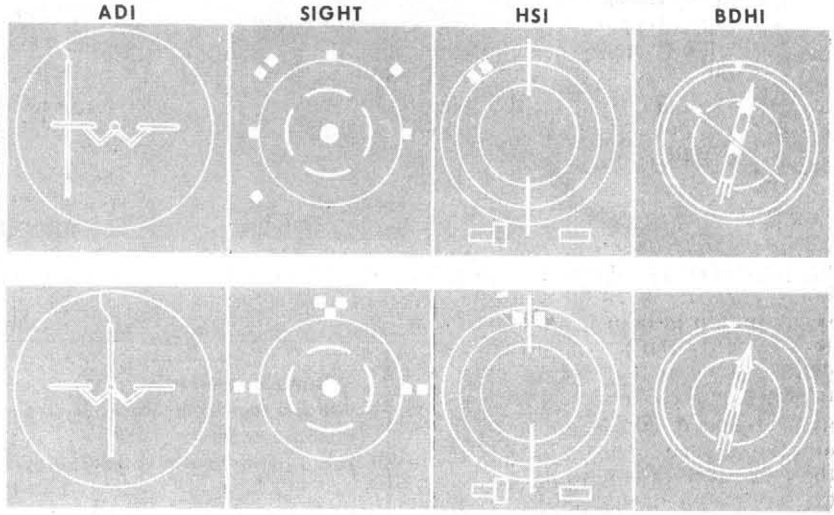
Optical Sight:
1. Caged Zero° Azimuth.
2. Reticle Depressed to the Radar Boresight Line.

AN/APQ-109 Mode:
1. MAP-PPI.
2. AI Range.

WRCS Manual Inputs:
WRCS Panel.
1. Target N-S/E-W Distance.
2. IP Altitude MSL.
3. Release Advance.
4. Release Range.

Cursor Control Panel:
5. Freeze Signal.
6. Target Insert Signal.
7. Cross Track Signal.
8. Along Track Signal.
9. Reset Signal.

INS Supplies:
1. Ground Speed.
2. Altitude MSL.
3. Ground Track.
4. True Heading.
5. Aircraft Velocity East.
6. Aircraft Velocity North.



F4D-34-I-218-1

Figure 1-29 (Sheet 1 of 4)

WITH VISUAL IP

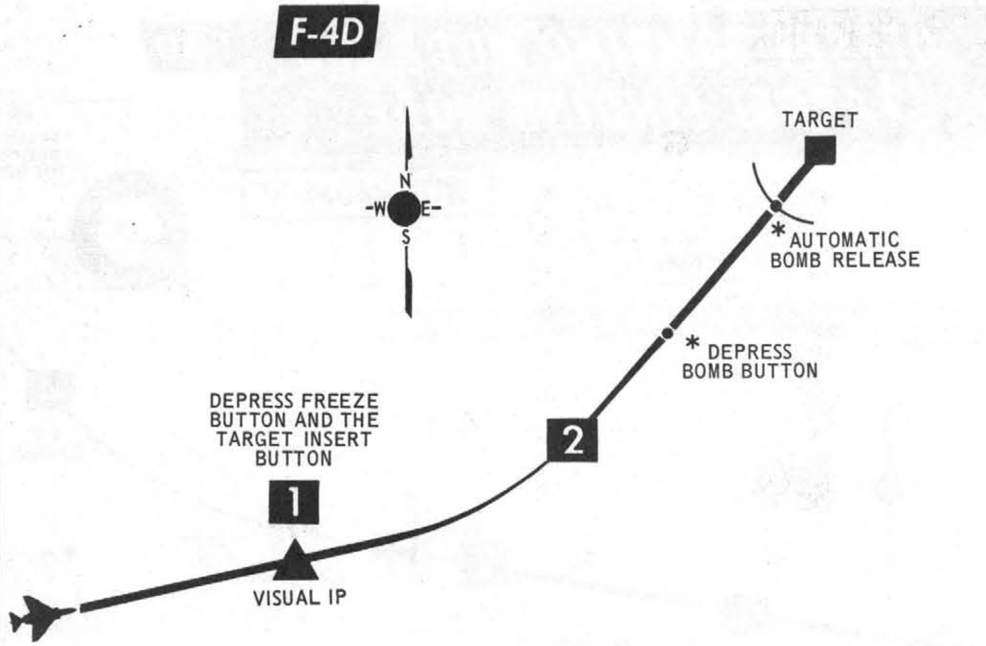
Optical Sight:
1. Reticle caged to the Radar Boresight Line.

AN/APQ-109 Mode:
1. Not Required

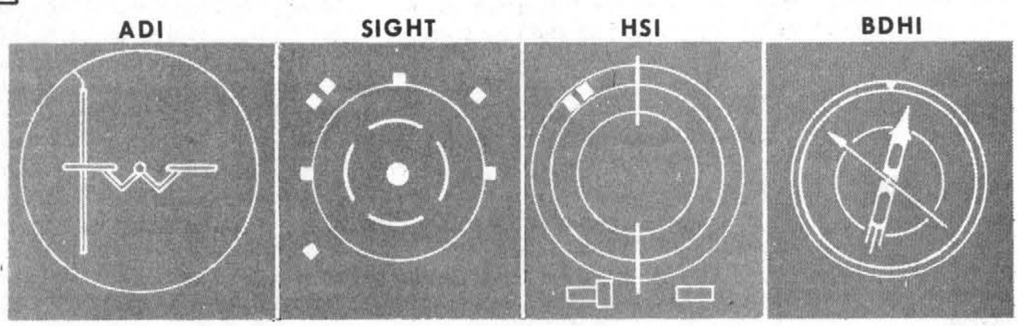
WRCS Manual Inputs:
WRCS Panel
1. Target N-S/E-W Distance
2. Release Advance.
3. Release Range.

Cursor Control Panel
4. Freeze Signal.
5. Target Insert Signal.
6. Reset Signal.

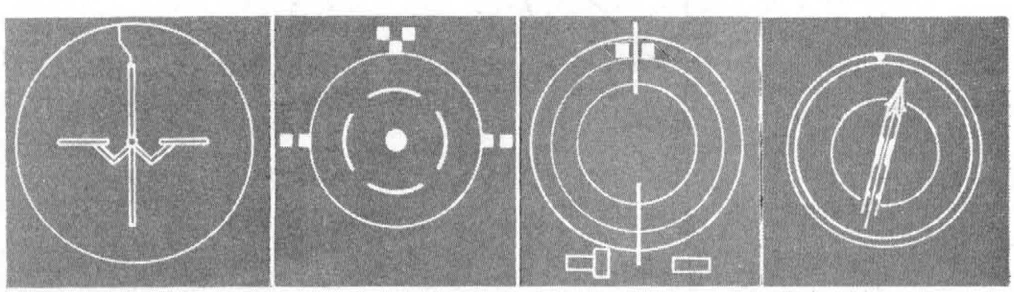
INS Supplies:
1. Ground Speed.
2. Altitude MSL.
3. Ground Track.
4. True Heading.
5. Aircraft Velocity East.
6. Aircraft Velocity North.



* OFFSET BOMBING MODE ONLY



1 Depress the Freeze Button and the Target Insert Button when Aircraft is over IP. Steering Information is Displayed.



2 Maneuver Toward the Indicator and Arrive on Course to the Target. Note: The Optical Sight is not Drift Stabilized.

> **Note**
>
> When over the target, the roll tabs rotate and the distance counters begin increasing in value displayed.

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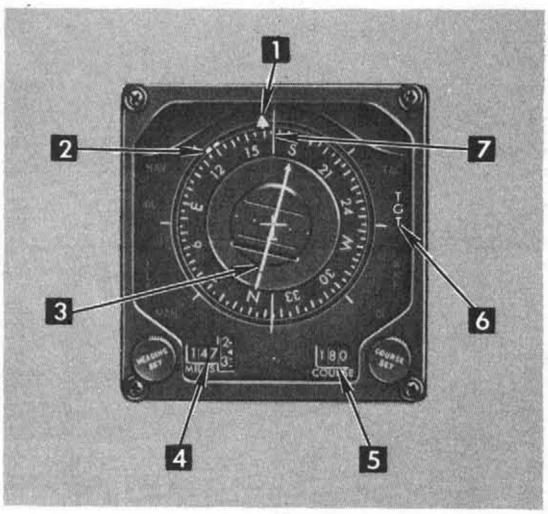
Figure 1-29 (Sheet 2 of 4)

F-4D

HSI INDICATIONS

FRONT COCKPIT



1 Bearing Pointer: Indicates the magnetic bearing to the target as computed by the WRCS computer and controlled by the NS/EW target distance counter.

2 Heading Marker: Indicates the magnetic heading to the target as computed by the nav computer and controlled by NS/EW target distance counter.

3 Course Arrow: Indicates the magnetic course of the aircraft (ground track), computed by the nav computer; same as Course Window.

4 Range Indicator: Indicates the horizontal distance (not slant range) to the target in nautical miles.

5 Course Window: Same as Course Arrow.

6 TGT Mode Light: Illuminates when the Target Insert button is pushed on (if the instrument lights are ON).

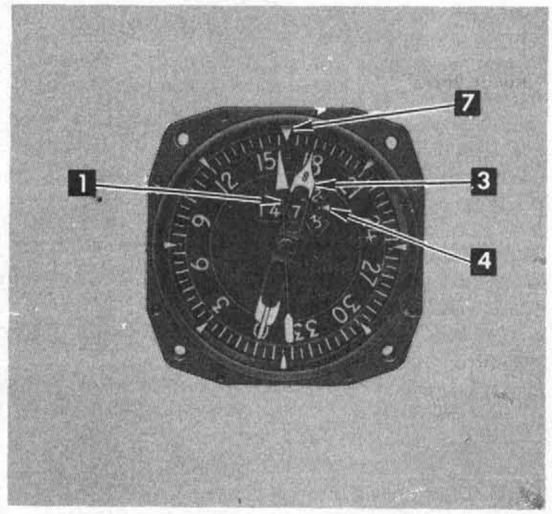
7 Lubber Line: Indicates the magnetic heading of the aircraft.

Note

When the aircraft is on the magnetic course to the target, the Bearing Pointer and the Course Arrow are aligned, and the Heading Marker is aligned with the top of the Lubber Line.

BDHI INDICATIONS

AFT COCKPIT



1 No. 1 Needle: Same as the Bearing Pointer on HSI.

2 NA

3 No. 2 Needle: Same as the Course Arrow on the HSI.

4 Range Indicator: Same as the Range Indicator on the HSI.

5 NA

6 NA

7 Top Index: Same as the top Lubber Line on the HSI.

Note

When the aircraft is on the magnetic course to the target, the No. 1 Needle is aligned with the No. 2 Needle.

F4D-34-1-218-3

Figure 1-29 (Sheet 3 of 4)

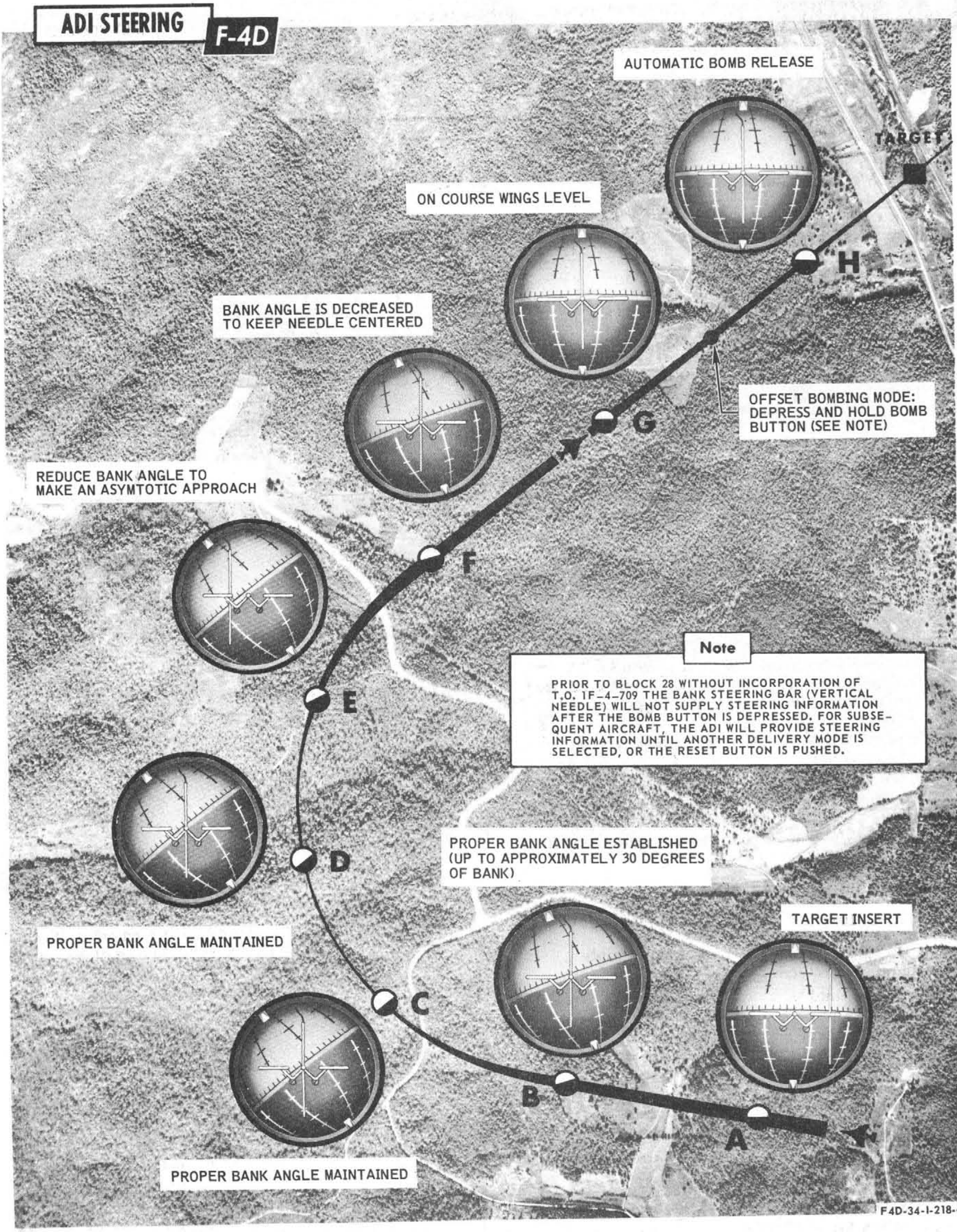


Figure 1-29 (Sheet 4 of 4)

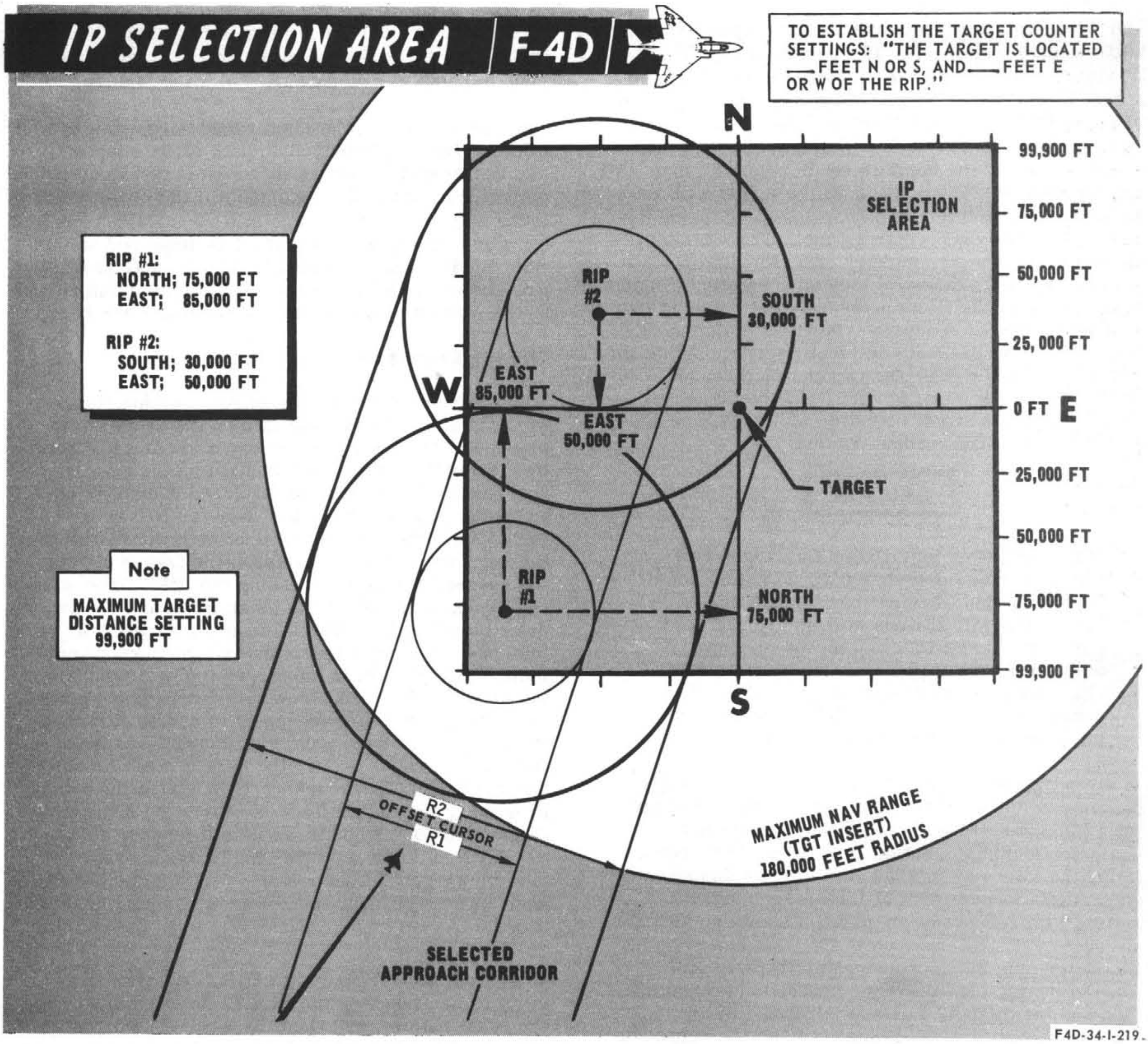


Figure 1-30

The AN/APQ-109 radar set is not used when a VIP is used, and the aircraft must be flown directly over the VIP to establish the aircraft position with respect to the target - the approach can be made from any direction. The final portion of the bombing run prior to bomb release is performed at the preplanned release speed and level approach altitude above target AGL. The release altitude is normally between 50 to 1000 feet; however, the release altitude can be as high as 50,000 feet if the bomb range does not exceed the release range control setting on the WRCS panel (X10 or X100).

The offset bombing mode is selected by placing the delivery mode selector knob to OFFSET BOMB and positioning the weapon selector knob to either BOMBS or RKTS & DISP (for dispensers only). The INS must be in operation for all WRCS modes. The optical sight is operated in the air-to-ground mode, and the AN/APQ-109 radar is operated in the MAP-PPI mode. The optical sight is electrically caged to 0° in azimuth, and to the radar boresight line in elevation. The roll tabs on the optical sight can be used to provide steering information that will guide the AC to the target; the ADI is the primary steering instrument. The radar will be stabilized in drift, roll, and pitch. The radar is used to identify the RIP and establish the aircraft position with the aid of the cursor panel.

After target insert, the drift stabilized MAP-PPI radar display can be used as the primary steering instrument by flying to center the offset cursor on its ZERO azimuth position. Also, after target insert, the radar should be switched to minimum scope range to further increase bombing accuracy. Before using the scope display as the primary steering instrument, the aircrew must establish the ZERO azimuth position of the offset cursor by performing the WRCS BIT check.

The WRCS computer receives manual inputs from the WRCS control panel. The IP pressure altitude (or IP altitude MSL) is placed in the readout control placarded ALT RANGE (the ALT light illuminates when OFFSET BOMB or TGT FIND is selected). The release advance control is set (if required), and the release range of the bomb is set in release range readout control. The position of the target with respect to the IP and the map coordinates is manually inserted in the WRCS control panel. For example, the target is located a number of feet north or south of the IP, and the target is located a number of feet east or west of the IP as measured on the target map or photos. (Refer to figure 1-30, IP selection area.) When the target presents an identifiable radar return and is used as the RIP, the target range readout controls must be set equal to zero, and the target pressure altitude (or target elevation MSL) must be set in the ALT RANGE readout control.

CAUTION

When a value is inserted on the target alt range counter other than 000, do not select the target find or offset bomb mode unless (a) the aircraft altitude MSL is greater than the value (times 100) or, (b) the aircrew is performing the target find/offset bomb BIT check as presented in section II. This is necessary to prevent possible damage to the pitch servo in the WRCS computer.

In situations where the known radar IP is actually higher than the required approach altitude, the aircrew can avoid (through correct planning) any equipment damage mentioned in the caution above. Using the following method, the mission planner determines a reciprocal altitude/range counter setting with respect to the planned approach altitude.

a. Determine the approach altitude above MSL.
b. Determine the difference between approach altitude and the (higher) radar IP altitude (MSL).
c. Subtract the value of step (b) from the approach altitude of step (a); place this amount on the ALT RANGE counter. This establishes an IP altitude and position which is as much below approach as the actual IP altitude is above approach, and the radar range to either point is the same.
d. During the mission, the AC must fly the planned approach altitude during freeze and target insert operations to assure that correct range data is available for the computer.

The cursor control panel is used to supply computer inputs which establish the position of the aircraft with respect to the IP or RIP and initiate computer operation. (These controls are discussed later.) The INS supplies the following aircraft position inputs to the computer:

a. Aircraft ground-speed.
b. The velocity vectors: north-south, east-west.
c. Aircraft altitude MSL (standard day).
d. Ground track.
e. Aircraft heading.

The computer uses these signals in conjunction with the MAP-PPI radar and the inputs from the cursor control panel to generate the following displays:

a. The position of the slant range cursor and the offset cursor is displayed on both radar scopes.
b. Horizontal ground range to the target is displayed on the HSI and BDHI instruments if the respective mode selector switches are in NAV COMP.
c. Steering angle of the target is displayed on the HSI, BDHI, ADI instruments, and the optical sight.
d. The bomb release signal is generated and routed to the weapons release circuit to release the bomb.

OFFSET RADAR IP

When using a radar IP, the offset bombing run begins when the RIP is identified on the scope. The pilot positions the range cursor below the RIP return by moving the along-track control on the cursor control panel. The cross-track cursor control is used to position the offset cursor over the RIP radar return. When the RIP return is at the intersection of the cursors, the pilot may push the freeze button; the cursors now begin tracking the RIP. After positive tracking of the RIP is established and the aircraft is within 180,000 feet from the target, the pilot may push the target insert button; the cursors automatically center over the target and begin tracking the target. The cursor controls can be operated at any time prior to Target Insert to update (touch-up) the position over the RIP. If the target can be defined on the radar scope, the cursor controls can be operated after Target Insert to update on the target, providing, the RIP altitude is nearly the same as the target altitude. When there is a difference between the RIP and target altitude, the target pressure altitude (or target elevation MSL) should be placed in the ALT RANGE readout control prior to updating on the target.

If a visual flyover fix on the RIP is desired after the cursors are tracking the target, the pilot must push the reset button, and when the aircraft is directly over the RIP, the freeze button and the target insert button are depressed simultaneously. Steering information will be presented to the AC on the ADI, the HSI, and the optical sight. Steering information is supplied to the pilot on the BDHI. The AC should use the ADI as the primary instrument to maneuver the aircraft on course to the target. Refer to figure 1-29.

Note

- Before T.O. 1F-4-709 in F-4D aircraft prior to Block 28; the vertical needle on the ADI cannot be used after the bomb button is depressed; the command heading marker and bearing pointer may be used or optical sight steering may be used. Ground track steering is not available; therefore, with a crosswind condition, the aircraft will fly an arcing flight path to the target.
- ADI steering will not be available if the weapon selector knob is on AGM-45.

After the target insert button is depressed and the steering displays are available, the AC maneuvers the aircraft in the direction indicated by the roll tabs on the optical sight to center the vertical needle on the ADI and/or center roll tabs on the optical sight (see figure 1-29). When the aircraft ground track is aligned with the target as indicated by the steering instruments, the AC should be flying the preplanned indicated altitude (using either 29.92 Hg or the forecast target altimeter setting) that will place the aircraft at the required altitude AGL. The bomb button must be depressed before the bomb release signal is automatically supplied to obtain a bomb release. The bomb button can be released and depressed again (prior to bomb release) without aborting the offset bombing run. The WRCS computer supplies the bomb release signal when the distance to the target, minus the bomb release range equals zero. Steering information to the target continues to be supplied. Another

bombing run on the same target can be made by flying the steering instruments and depressing the bomb button prior to the bomb release point; however, this method increases the navigation range which will decrease bombing accuracy.

WARNING

If the bomb button is depressed (and held depressed), after the bomb release range is passed, the bomb will not be released until the aircraft has traveled beyond the target a distance equal to the preset bomb range.

VISUAL IP FLY-OVER

When an IP is chosen that will not provide a suitable radar return, the aircrew must visually identify the IP, and the aircraft must be flown directly over the IP. The freeze button and the target insert button are depressed simultaneously when the aircraft is directly over the IP. The steering displays are then available and the AC maneuvers the aircraft accordingly. If the MAP-PPI radar is in operation, the cursors will center over, and begin tracking the target. Prior to the IP, the reset button should be pushed to ensure that the cursors are at zero-zero; and, the along-track, cursor control must not be moved prior to IP. The use of a visual IP will produce greater bombing accuracy than for use of a radar IP. This is due to the inherent radar ranging tolerance error of the radar, and the position error of cursors in establishing the exact location of the RIP with respect to the aircraft. Bombing range error can be further reduced by choosing an IP that is located as near as possible to the bomb release point, thereby, reducing the navigation distance.

TARGET FINDING MODE

The target finding mode (figure 1-29 sheet 1) is provided to aid the aircrew in navigation from a radar or visual IP to the target area. The operating procedures and steering displays are identical to the offset bombing mode; the target-finding mode does not supply a bomb release signal. When the aircraft is over the target, the ADI vertical needle moves off to the side and the roll tabs on the optical sight will rotate, and the range indicator counter begins to increase in value displayed. (The range indicators may not reach 000 MILES.)

The target finding mode is selected by placing the delivery mode selector knob to TGT FIND and the navigation computer switches in the NAV mode. The AN/APQ-109 radar is operated in the MAP-PPI mode and the optical sight in the A/G mode. The applicable switches of the ensuing bomb delivery mode may be preset. The operating altitudes for this mode are between 50 feet and 60,000 feet AGL. Steering information is removed when another delivery mode is selected or the reset button is pushed.

An alternate use of the target-finding mode is as an aid to update the ASN-46 navigation computer set from a radar IP having known coordinates. Set the north/south and east/west target distance counters for a real or imaginary target with reference to the RIP. The target is the location where INS updating will occur. Position the update switch to SET and dial the latitude and longitude coordinates of the real or imaginary target in the navigation computer control panel. The pilot uses the cursor controls to establish a computer fix on the RIP, depresses the freeze button and the target insert button, and the AC maneuvers toward the target. Place and hold the INS update switch in the FIX position. When the BDHI miles-to-go target counter reads zero and the bearing needle swings through 90° to the aircraft heading, release the update switch to the normal position.

WRCS/LABS DELIVERY MODE

F-4D-32 and up; F-4D-24 thru 31 after T.O. 1F-4-702, the combined WRCS/LABS delivery modes are available.

This modification to the weapon system enhances the bomb delivery capability in both visual and non-visual flying environments. The modification is accomplished essentially for nuclear weapons deployment. However, the equipment and delivery methods will also apply in certain situations involving non-nuclear weapons. Hence, the following discussion involves no specific bomb, but simply assumes that some bomb(s) — either high or low drag — is aboard the aircraft.

The AC may select any one of six LABS bombing modes (including DIRECT) on the delivery mode selector. The modified equipment will allow the aircrew to energize and use the WRCS target find functions in conjunction with any of these LABS modes, and most specifically, the AN/AJB-7 modes (LADD, LOFT, and O/S). In this case, the WRCS system is being used to deliver an AN/AJB-7 activate signal at the proper range from target and along any ground track projected directly through the target. The following is a general analysis of modifications that immediately affect aircrew operations.

a. The weapon delivery panel (figure 1-31) is on the rear cockpit right console. The panel includes the activate control switch, the target find switch, and the range switch. These are lock-toggle switches that detent laterally into position.

b. The WRCS system is programmed to provide an extended release range scale to 100,000 feet. This pertains to the activate range in an ASQ-91/AJB-7 integrated mode, or the release range (R_R) in a WRCS mode.

c. The WRCS release altitude operational limit is extended to approximately 18,000 feet in the dive toss mode.

d. The addition of a gyro fast erect switch for the AN/AJB-7 gyro system.

Figure 1-31

OPERATION

In the following discussion, it is assumed that the aircrew is familiar with AN/AJB-7 bombing methods and the WRCS target find mode as they function when individually selected. Also the aircrew must have selected the weapon aboard and performed all pre-arming functions. Assume here that the aircrew intends to plan the LADD/Target find bombing mission (figure 1-32).

The aircrew selects TIMED LADD, and energizes the appropriate release and arming switches for the type of weapon aboard. The flight director instruments are placed in the nav. comp. operating mode, and the optical sight is operated in the A/G mode. On the weapon delivery panel, the pilot must select HOLD on the target find switch; the HOLD position selects the WRCS target find mode of operation.

The WRCS computer control panel is set as it normally would be for offset bomb operations. The only difference is that the release range (R_R) counter must be set with a number representing range from pullup to burst, which is quoted in the appropriate LADD ballistics table. Assume that the ballistics table range (R_B) is quoted at 14,000 feet. This is the range at which the WRCS system delivers a signal activating the LADD system. The aircrew should allow for a small amount of lead-in time at pullup. The lead-in time compensates for any delay in pilot reaction time, and allows time for the AN/AJB-7 to activate into the LADD mode. A feasible lead-in interval is 1 second, which is placed on the pullup timer (T_1 interval, figure 1-32). Therefore, the R_R setting on the WRCS control panel is

$$R_R = R_B + V_A\ (1.69)\ T_1.$$

where R_B is the bombing table range. V_A is approach velocity in knots, and T_1 is the desired lead-in time. For a 1.0 second T_1 interval and 550 KTAS approach, the R_R setting would be 14,900 feet. In the R_R counter, the pilot would place 149 on the dial and energize the range switch to (X100) on the weapon delivery panel. Finally, the pilot sets the T_2 interval on the release timer.

Note

- The selection of 1.0 second for a lead-in interval is only intended as an example here. Whatever the setting is, it should be as small as possible since chances of distance error at the pullup point are increased with longer T_1 intervals. Also, the activate tone is triggered at the activate point, regardless of the value placed on the pullup timer. Hence, the tone may be used both as an activate signal and a pullup warning signal only if the pullup timer is set on a low value. Finally, if T_1 is set to zero, the 0.38 second activate tone occurs directly at the pullup point.

- With the range switch on (X100), the (X10) factor on the release range counter has no meaning. The range switch is also functional in any WRCS mode that requires an R_R setting.

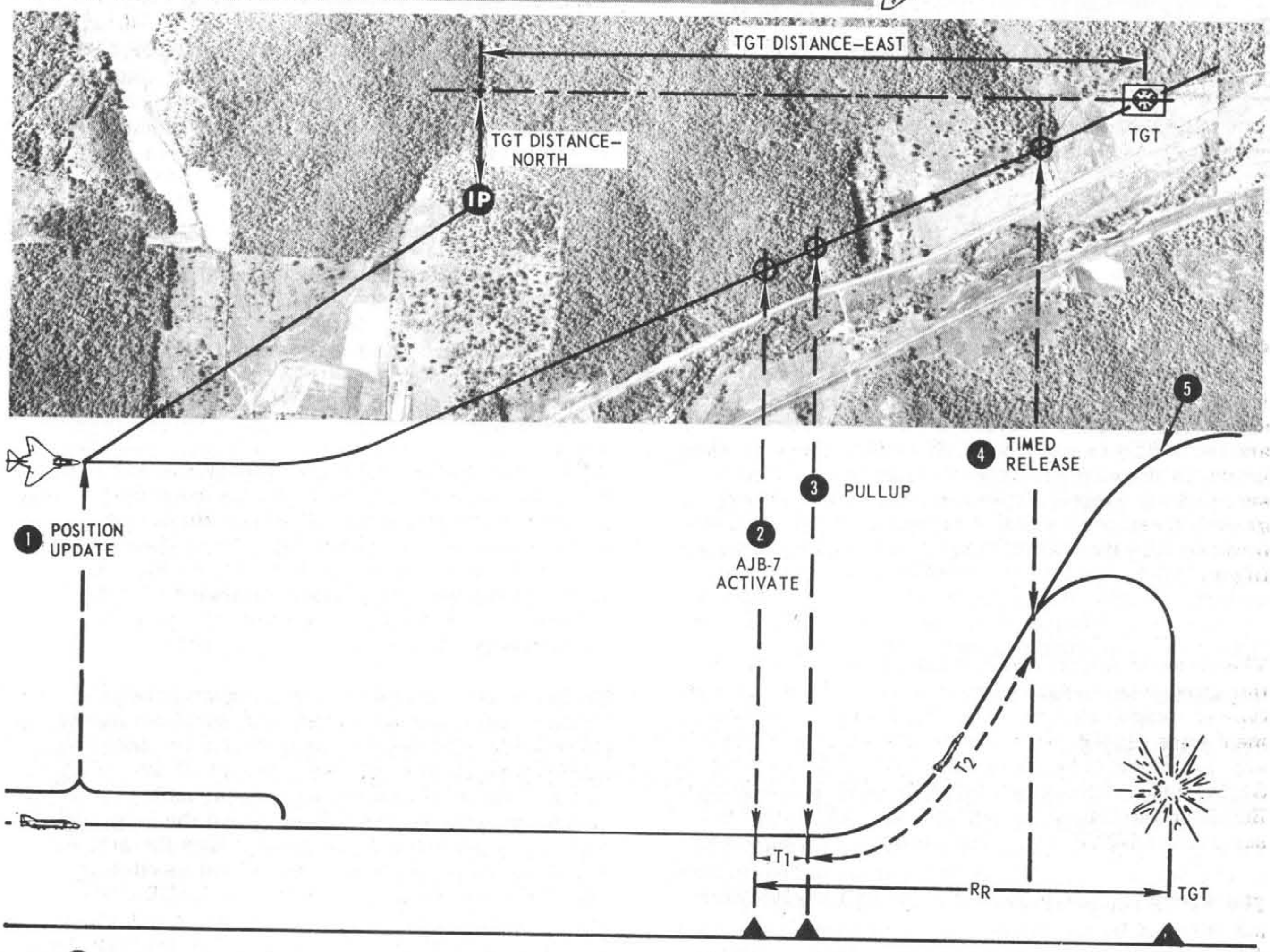
- For the WRCS/LABS modes, any release advance (R_A) setting on the WRCS panel advances the activate point by the amount set into the counter. Normally, the counter should be set on zero. However, an R_A setting may be used to apply a tailwind correction or to apply a reaction time correction during the TGT FIND/DIRECT mode.

As figure 1-32 indicates, the AC approaches the target area using normal target find (or offset bomb) procedures. The aircrew may select the target as the IP, use an offset IP, or a visual IP fly-over procedure may be used depending on the nature of the target and weather conditions. Once the target insert function is performed, the pilot places the activate switch to ON. Note that if the activate switch is placed ON before target insert, the LADD system could energize prematurely. (At target insert, the WRCS range servos position out to the aircraft range from target. If the servos pass through the R_R setting, the AN/AJB-7 system could activate at that instant.)

When the aircraft reaches the AN/AJB-7 activation range (14,900 feet in this case), a signal from the WRCS triggers the activate tone and starts the pullup time (T_1). At this point, the ADI needles switch into the AJB-7 mode, but the remaining steering devices continue indicating target find steering. The activate tone lasts about 1/3 second, which means that the AC has about 2/3 second remaining to react and begin pullup as the T_2 interval (release timer) begins.

Notice that the bomb button may be depressed anytime during the (T_1 + T_2) interval; AN/AJB-7 activation occurs automatically and independently of the bomb button when reaching the set R_R range. However, if the pickle signal is delivered before reaching the activation range, the AN/AJB-7 sequence will begin immediately. Also, if the AC inadventently releases the bomb button during (T_1 + T_2) interval, the signal may be reapplied before T_2 run-out without aborting the run. The lock-out relays are bypassed in the WRCS/AJB-7 modes.

WRCS/LADD DELIVERY MODE F-4D



1 POSITION UPDATE

1. Pilot positions WRCS cursors over IP and depresses FRZ control.
2. Pilot depresses TGT INS control, steering displayed on HSI, ADI, reticle, and BDHI. AC steers to null azimuth indicators.
3. Pilot selects ACTIVATE <u>after</u> cursors and steering devices complete transition to target.

2 AJB-7 ACTIVATION (R_R)

1. Activate tone sounds (0.38 sec. beep) and T_1 time starts. (T_1 = 1.0 sec. lead-in time.)
2. ADI pointers centered.
3. Pullup light on.
4. AC starts pullup.

Note

- Bomb button signal may be delivered anytime during $T_1 + T_2$.
- All other steering instruments (except ADI) continue WRCS steering.

3 PULLUP

1. AT T_1 = 0, pullup light off.
2. Reticle light off.
3. Steady tone on.
4. T_2 time starts.
5. ADI pointers:
   Horizontal - LADD vertical flight path.
   Vertical - yaw/roll error.
6. Bomb button signal must be delivered before T_2 = 0.

4 RELEASE

1. AT T_2 = 0, release occurs.
2. Pullup and reticle light on.
3. Tone off.
4. ADI vertical pointer out of view.

5 RELEASE BOMB BUTTON

1. Pullup light off.
2. ADI vertical pointer-WRCS steering.
3. ADI Horizontal pointer out of view
4. WRCS steering continues, aircrew may re-attack from another direction.

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Figure 1-32

Note

The 1/3-second activate tone mentioned here is available only in the WRCS/LABS delivery modes. If the AGM-45 is to be delivered using the WRCS/LOFT mode, the pullup activate tone is not available.

The pullup-to-release portion of the LADD maneuver, with which the aircrew is familiar, is flown as figure 1-32 indicates. Aircrews may easily equate the procedures shown in the figure 1-32 to any other LABS maneuver. With a LOFT or O/S mode selected for example, release occurs through the AN/AJB-7 gyro rather than the release timer. The R_R counter is set as a function of the desired pullup distance from target, which would be nearly zero in an O/S mode and conceivably as much as 30,000 feet in a LOFT mode. Also, with the R_R counter set for a known bomb range, the AC can select DIRECT and apply the release signal when the activate tone sounds. In this case, the aircrew has a DIRECT/TGT FIND release mode. After bomb release, the WRCS target find mode continues to function and the AC may reattack, provided that the navigation range of the WRCS is not exceeded (30 nautical miles). If the AC desires, the system is completely recycled by placing the activate switch to NORM and by depressing the reset button on the cursor control panel. The AN/AJB-7 system recycles automatically at bomb release.

WEAPON DELIVERY PANEL

TGT Find Switch

The selective functions of the target find switch and the TGT FIND mode on the delivery selector are identical. If the AC selects a WRCS mode on the delivery selector, the target find switch has no function and should remain in NORM. The HOLD position energizes the target find circuits along with any LABS mode (including OFF) that the AC selects.

Range Switch

The range switch is functional in any WRCS mode that requires an R_R setting. The (X100) position applies a multiplier of 100 to whatever digit the pilot places in the R_R counter. In NORM, a factor of 10 is applied to the R_R setting.

Activate Switch

Voltage is available for the activate switch when the target insert button is depressed. Placing the activate switch to ON provides continuity to activate circuits in the weapon release computer. These circuits close only when the aircraft range from target becomes equivalent to the set R_R range. This applies the activate signal to the selected LABS circuits and the associated indicators. To avoid premature activation, select the ON position only after target insert, and only after the range and steering devices have transitioned to the target. If the activate switch is left in NORM, the system is operating in a target find mode where an R_R setting has no meaning.

AUX ARMAMENT CONTROL PANEL

Gyro Switch

The AC may fast-erect the AN/AJB-7 gyro platform by selecting the momentary FAST ERECT position on the gyro switch. This applies an electrical cage signal to the gyro caging mechanisms. As the caging signal is applied, the aircraft should be in level, nonaccelerating flight. The switch would have application, for example, to correct any noticeable gyro precession during the level, constant speed target run-in.

JETTISON CONTROLS (F-4D)

EMERGENCY JETTISON

Illustrations that demonstrate the jettison methods and controls are provided in section III. The inboard and outboard MAU-12 armament pylons cannot be jettisoned. The applicable jettison controls will jettison the MER's, TER's, or weapon suspended from the armament pylons. The LAU-34/A launcher cannot be jettisoned; the jettison controls will jettison the AGM-12B or AGM-45 from the launcher without motor ignition. The LAU-7A/A and AIM-4D launchers are bolted to the inboard armament pylon and cannot be jettisoned; the applicable jettison controls launch the missiles with motor ignition. When the inflight lockout pins are installed, the LO, RI and LI unlocked lights on the DCU-94/A control-monitor illuminate. The RO UNLOCKED light does not illuminate when the lockout pin is installed.

EXTERNAL STORES EMERGENCY RELEASE BUTTON

The external stores emergency release button, placarded EXT STORES EMER REL, is a momentary contact, pushbutton switch used to jettison all stations simultaneously. This control is referred to as the panic button. The button is in the front cockpit on the left vertical panel. Jettison procedures and the conditions are contained in section III.

SELECTIVE JETTISON

CENTERLINE STATION JETTISON

The centerline station jettison switch (figure 1-33) is a cover-guarded switch on the left console fuel control panel. The switch has two positions: NORM and JETT. The switch is spring-loaded to NORM. Placing the switch to JETT supplies jettison voltage to the centerline station. Refer to section III, Jettison procedures.

INBOARD WING STATION (MISSILE JETTISON SELECTOR)

The missile jettison selector knob is a rotary type pushbutton switch on the missile status panel. This switch provides selective jettison of the fuselage missiles and inboard wing stations. The switch positions are as follows: OFF, R FWD, R WING, R AFT, ALL, L AFT, L WING, and L FWD. Jettison voltage is supplied to the left or right inboard stations by selecting L WING or R WING, and pushing the jettison button. Refer to section III, Jettison Procedures.

OUTBOARD WING STATION JETTISON

The wing station jettison switch placarded WING STA JETT, is a cover-guarded, momentary contact switch, spring-loaded to NORM. The switch is on the fuel control panel. The switch has two positions: NORM and JETT. Placing the switch to JETT supplies jettison voltage to the left and right outboard wing stations. Refer to section III, Jettison Procedures.

Outboard Station Selective Jettison (After T.O. 1F-4-863)

The outboard pylon jettison select switch (figure 1-33) provides a selective jettison function for the outboard wing stations. The switch is positioned to either LEFT, RIGHT, or BOTH, and then the wing station jettison switch is energized to jettison the contents of the outboard station(s). This is actually a five-position switch with two positions not placarded. The center (straight up) position is OFF; the inboard position is not in use and is essentially another OFF position. Selecting either of these (OFF) positions disables the wing station jettison switch. The selective LEFT and RIGHT positions enable the AC to meet specific jettison limitation requirements if an unsymmetrical external store load exists on the outboard stations.

ARMAMENT SAFETY OVERRIDE PANEL

The armament safety override button is a push type switch consisting of a holding coil and three individual double pole switches ganged together by a common plunger shaft and is spring-loaded to OFF. The control is above the left console in the front cockpit. When the override button is depressed, 28v dc is directed to the holding coil from the R 28v dc bus. This holding coil keeps the override button depressed, and directs power from the essential 28v dc bus to emergency jettison circuits and from the R 28v dc bus to the armament bus relay. The jettison circuits are placed in an inflight configuration.

WARNING

With the armament override button depressed, a hazard exists if a centerline station fuel tank is jettisoned on the take-off roll.

LANDING GEAR CONTROL HANDLE

The landing gear control safety switch is integral with the landing gear control handle and is used to prevent the inadvertent application of electrical power to the armament circuits. When the gear handle is UP, this switch directs electrical power from the R 28v dc bus to the No. 1 miscellaneous relay panel, closing the armament bus relay. The armament bus relay then supplies electrical power to the armament circuits. When the gear handle is DOWN power is applied through the safety switch to the armament safety override button holding coil; thus, the armament safety override button remains pulled in when depressed.

LEFT MAIN GEAR SCISSOR SWITCH

The left main gear scissor switch is mounted on the left main gear strut; it is actuated by a cam on the bottom of the gear scissor hinge. When the strut extends, the scissor links spread and the cam rotates against the scissor switch, depressing the plunger. The scissor switch makes contact when the plunger is depressed. This switch, when closed, will allow electrical power to go from essential 28v dc bus to the external stores jettison switch, centerline tank jettison switch, and the nuclear weapons jettison switch. The armament safety override button bypasses the gear scissor switch and supplies electrical power to the jettison and release circuits for ground operation.

NUCLEAR STORES RELEASE AND JETTISON

Most equipment suspended from both inboard armament pylons, the left armament pylon and the Aero 27A centerline bomb rack can be jettisoned through the nuclear store release circuit DIRECT release mode. This is accomplished through the DCU-94/A control monitor and the bomb button. Refer to section III for procedures. The nuclear release circuit (DIRECT mode) will not jettison the left outboard MER when the MER is shifted aft. The nuclear jettison circuit (NUCLEAR PUSH TO JETT) will jettison a left/aft shifted outboard MER. However, the right outboard station could also jettison even though only the left outboard station is selected on the DCU-94/A.

CAUTION

In F-4D aircraft with T.O. 1F-4-801, the nuclear store release and jettison circuit should not be used for selective jettison from a particular station. The nuclear store jettison button (NUCLEAR PUSH TO JETT) should be used as a last resort, and only when the inadvertent jettison from unselected stations is of little concern. For example; the fuselage missiles may jettison, and both inboard stations and CL station may jettison even though only the right or left inboard station is selected on the DCU-94/A. Both outboard stations and CL station may jettison even though only the left outboard station is selected on the DCU-94/A. When the centerline station is selected, only the centerline station is expected to jettison.

ECM POD JETTISON (STATION 9)

On aircraft F-4D-24 thru F-4D-30 an ECM pod on station 9 is jettisoned by placing the wing station jettison switch to JETT. However, this jettisons the contents of both wing stations. On aircraft F-4D-31 and up, an ECM jettison switch (figure 1-33) provides station 9 ECM pod jettison capability. The two-position cover guarded switch is placarded JETT and NORM. The ECM pod may be jettisoned independently from station 9 (other armament retained) by placing the switch in the JETT position. Also, the wing station jettison switch may be used to jettison stores from the left outboard station without releasing the ECM pod. When armament is carried on stations 1 and 9, the ECM jettison switch is bypassed and the wing station jettison switch jettisons armament from both outboard stations. Inadvertent pod release during ground operation is inhibited by the protective circuits discussed earlier in this text. After T.O. 1F-4-863, the outboard station selective jettison switch may be used to individually jettison the outboard station load.

MULTI-STATION ECM POD JETTISON

After T.O. 1F-4-821, ECM pod provisions are added to stations 2 and 8. Also after T.O. 1F-4D-547, multi-station ECM capabilities include stations 2, 4, 5, 6 and 8. ECM pods on stations 2, 5, and 8 are jettisoned by following the normal jettison procedures for those stations. Jettison controls are illustrated on figure 1-33. ECM pods on stations 4 and 6 cannot be jettisoned.

JETTISON CONTROLS F-4D

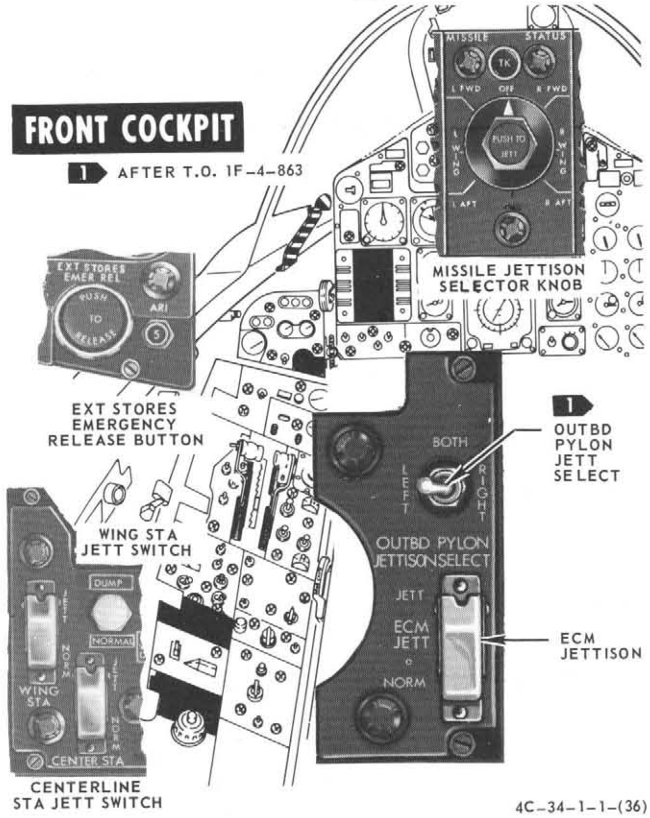


Figure 1-33

Note

ECM pods (except pods on stations 4 and 6) are also jettisoned by depressing the external stores emergency release button. However, any decision to jettison ECM pods must be left to the proper command authority.

MISSILE JETTISON

The jettison circuitry within the firing circuits is controlled by the missile jettison knob on the missile status panel. The AC may manually select only one of the fuselage missiles, or either of the inboard wing stations for jettison. Before the missiles can be jettisoned, the emergency landing gear handle must be IN and the weight must be off the landing gear or the landing gear handle must

be UP. For ground checkout purposes, these interlocks can be bypassed with the armament safety override button.

Radar Missile Jettison

When the missile jettison knob is pushed to jettison the fuselage stations, the ejection squibs are activated any time power is on the aircraft. The ejectors used to launch the fuselage missiles are activated by jettison voltage and not the fire voltage. These ejectors are gas cartridges which explode to eject the missile downward from the fuselage. The jettison circuitry for the two forward fuselage missiles is interlocked in such a manner that, if the TK light is illuminated, the missiles cannot be jettisoned. The AIM-7D/E missiles are jettisoned without motor ignition.

Note

After T.O. 1F-4-750, the TK light is on before and after the M118 or MK 84 bomb is released when the centerline single bomb shorting plug is installed. Even though the TK light is on, the tank aboard relay is not energized, permitting the two forward AIM-7 missiles to be monitored, launched, and jettisoned.

Heat Missile Jettison

The jettison knob on the missile status panel allows the pilot to jettison the AIM-4D and AIM-9 missiles. The AIM-4D jettison sequence is not the same as the firing sequence. For left wing: L BOTTOM, after 0.2 sec., L INBOARD. For right wing: R INBOARD, after 0.2 sec., R BOTTOM. For ALL: L BOTTOM and R INBOARD, after 0.2 sec., L INBOARD and R BOTTOM. When the missiles are jettisoned, the rocket motors are ignited and the missiles are fired ballistically (no guidance, no self destruct). The normal preparation of the missiles is not accomplished; therefore, the warhead fuze in the missile is not armed at launch. There is a 0.2-second delay between two AIM-4D missiles launched on the same station. The flaps must be UP to jettison the AIM-4D or AIM-9 missiles. The AIM-4D and AIM-9 launch and jettison circuit is interlocked with trailing edge flaps circuit to prevent interference during launch. The speed brakes may sustain damage if they are extended during missile launch or jettison. The landing gear must be up to jettison the AIM-4D missile. For AIM-9 jettison, the weight must be off the left main landing gear, i.e., the AIM-9 can be jettisoned if the gear is down and the aircraft is in flight. For AIM-4D missiles, the gear up relay is located in the AIM-4D launcher and prevents AIM-4D launch and jettison until the gear is up (left main gear door closed).

SUSPENSION EQUIPMENT (F-4D)

BRU-5/A BOMB RACK (AERO-27/A)

The BRU-5/A bomb rack (figure 1-34 sheet 3) is a self-contained ejector unit mounted within the aircraft at centerline station 5. The Aero-27/A rack has four suspension hooks: two 14 inches apart and two 30 inches apart. The BRU-5/A rack has only 30-inch hooks, and arming solenoids in place of the 14-inch hooks. An ejector piston is located in the center of the rack. Operation of the rack hooks and the ejector piston is initiated through the jettison circuit or the nuclear release circuit by igniting two ejector cartridges. Gases from the ejector cartridges cause the rack hooks to open and the ejector piston to push downward on the bomb or suspension equipment. With the bomb rack safety pin installed, an electrical safe switch is opened to prevent the cartridges from firing; the pin is removed prior to flight. The MER cannot be suspended from the bomb rack without the centerline bomb rack adapter. The weight of the Aero 27/A bomb rack (51 pounds) is not included in the basic weight of the aircraft and must be included in any gross weight computation. The weight of the BRU-5/A is 45 pounds.

After T.O. 1F-4-750, the two 14-inch suspension hooks are replaced by two arming solenoids. A centerline single bomb shorting plug is installed to permit the release of the MK 84 or M118 GP bomb through the conventional release circuit. Illumination of the TK light reveals the installation of the shorting plug.

Note

Even though the TK light is on, the tank aboard relay is not energized; therefore, the forward AIM-7 missiles can be monitored, launched, and jettisoned.

After the bomb is released, the amber station select light remains on and the TK light also remains on. The M118 or MK84 on centerline can be jettisoned with the external stores jettison button, the centerline tank jettison switch, the nuclear store jettison button, and can be released through the DCU-94/A control monitor.

CENTERLINE BOMB RACK ADAPTER

The centerline bomb rack adapter is attached to the centerline position to accept the MER assembly. The adapter is compatible only at the centerline, and attaches directly to the BRU-5/A bomb rack. The adapter weighs 55 pounds.

MAU-12B/A, C/A ARMAMENT PYLONS

The inboard and outboard armament pylons (figure 1-34, sheets 1 and 2) are bolted to the wing at stations 1, 2, 8, and 9. The pylons cannot be jettisoned. Each armament pylon assembly includes the MAU-12B/A ejector rack, weapons relay panels, a power rectifier, and bomb release circuits. The ejector rack contains two cartridge breeches and ejector pistons, 14 and 30-inch suspension hooks, three arming wire solenoids, and a solenoid operated assembly that electrically locks (safeties) the cartridge fire circuit. When the cartridges detonate, gas pressure opens the rack hooks and forces the pistons downward, ejecting the bomb. To compensate for various bomb CG locations, orifices are installed into the rack to control bomb separation characteristics by varying the forces delivered to each piston. The ground safety pin when installed provides only a mechanical lock in the hook linkage for ground safety purposes. The inflight safety lockout solenoid electrically isolates the cartridges by mechanically controlling two switches that break the cartridge circuit. The lock must be removed when the MER or TER is aboard by manually installing the inflight safety lockout pin (or bolt) in the pylon. The bolt is installed only for non-nuclear bomb carriage and must be removed for nuclear carriage. When the bolt is installed, the DCU-94/A UNLOCK light for that station illuminates continuously (except the RO UNLOCK light). The arming wire solenoids are controlled by the position of the arm nose tail switch.

Note

The MAU-12C/A is completely interchangeable with the MAU-12B/A armament bomb rack. The MAU-12C/A is a strengthened MAU-12B/A.

MULTIPLE EJECTOR RACK (MER)

The multiple ejector racks, used at the outboard wing stations and the centerline station are: MER-10 and -10A. The MER-10A functions differ from the MER-10 as follows:

a. Only the loaded MER-10A stations receive a release pulse regardless of the arm nose tail switch position.

b. The MER-10A is automatically homed to the first loaded station in sequence each time power (28v dc Ess Bus) is applied to the aircraft. The MER-10A does not have a homing light.

c. The step switch on the MER-10A is used for ground checkout operation.

The MER has two suspension lugs mounted 30 inches apart. The MER consists of six 14-inch ejector units, 12 arming solenoids, the control unit and wire bundles required to arm, and the release and/or fire munitions carried. Each ejector rack or point is identified with a number corresponding to its release sequence. All MER's are rigged 1° nose down for rockets. The centerline MER weight is 215 pounds, the outboard MER weighs 225 pounds.

TRIPLE EJECTOR RACK (TER)

The triple ejector racks used at the inboard wing stations are TER-9 and TER-9A. The TER-9A function differs from the TER-9 as follows:

a. The TER-9A is automatically homed to the first loaded station in sequence each time power (28v dc Ess Bus) is applied to the aircraft. The TER-9A does not have a homing light.

b. The step switch on the TER-9A is used for ground checkout operation.

c. Only the loaded TER-9A stations receive a release pulse regardless of the arm nose tail switch position.

The TER has two suspension lugs mounted 30 inches apart. It consists of three 14-inch ejector units, six arming solenoids, control unit and wire bundles required to arm, release, and/or fire munitions that are carried. Each ejector rack or point is identified with a number corresponding to its release sequence. TER's are permanently rigged 1° nose down. The TER weighs 95 pounds.

LAU-34/A LAUNCHER

This assembly must be used to carry and launch the AGM-12B and AGM-45A missiles. The launcher contains the electrical circuits and relays which are responsible for the dispersal of missile pre-heat, pre-arm, and missile launch voltage. The method of carriage is illustrated (figure 1-34 sheet 1). The launcher also contains a cartridge-fired jettison gun assembly. Expanding gas from the detonated cartridges operates the assembly and slides the missile rearward free of the launcher rails. The missile freefalls in an inert state.

REHOMING MERS AND TERS

A hung bomb can be released, in some cases, after rehoming the MERs and TERs. Rehoming is accomplished in flight by cycling the weapon selector knob from BOMBS to RKTS & DISP and back to BOMBS. This action causes the station stepper switch in all MER/TERs aboard to move from the OFF position to the first loaded station in sequence. The stepper switch will not move if on a loaded station or the MER/TER is empty. (A defective store aboard sensing switch could cause the MER/TER to appear empty.) The MER/TER stepper switch OFF position is obtained only in the BOMBS mode and after a release pulse has been sent to each of the loaded stations on the MER or TER. Additional bomb release pulses will not move the stepper switch from the OFF position. Selecting RKTS & DISP moves the stepper switch from the OFF position because there is no OFF position in the MER/TER with the RKTS & DISP mode. The MER/TER stepper switch always steps to the next loaded station and continues to repeat the cycle when the RKTS & DISP mode is used.

SUSPENSION EQUIPMENT F-4D

INBOARD ARMAMENT PYLON

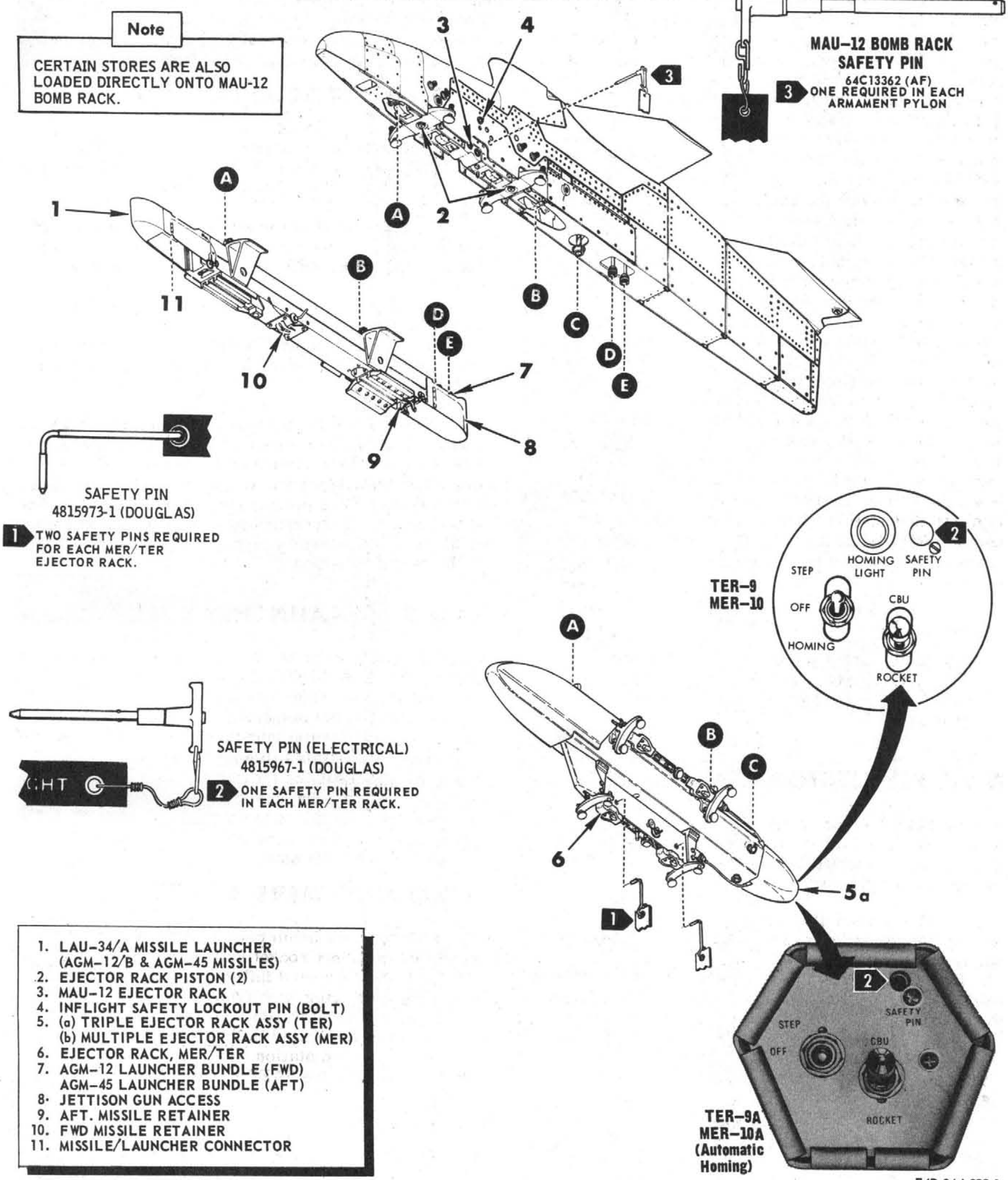


Figure 1-34 (Sheet 1 of 4)

OUTBOARD ARMAMENT PYLON F-4D

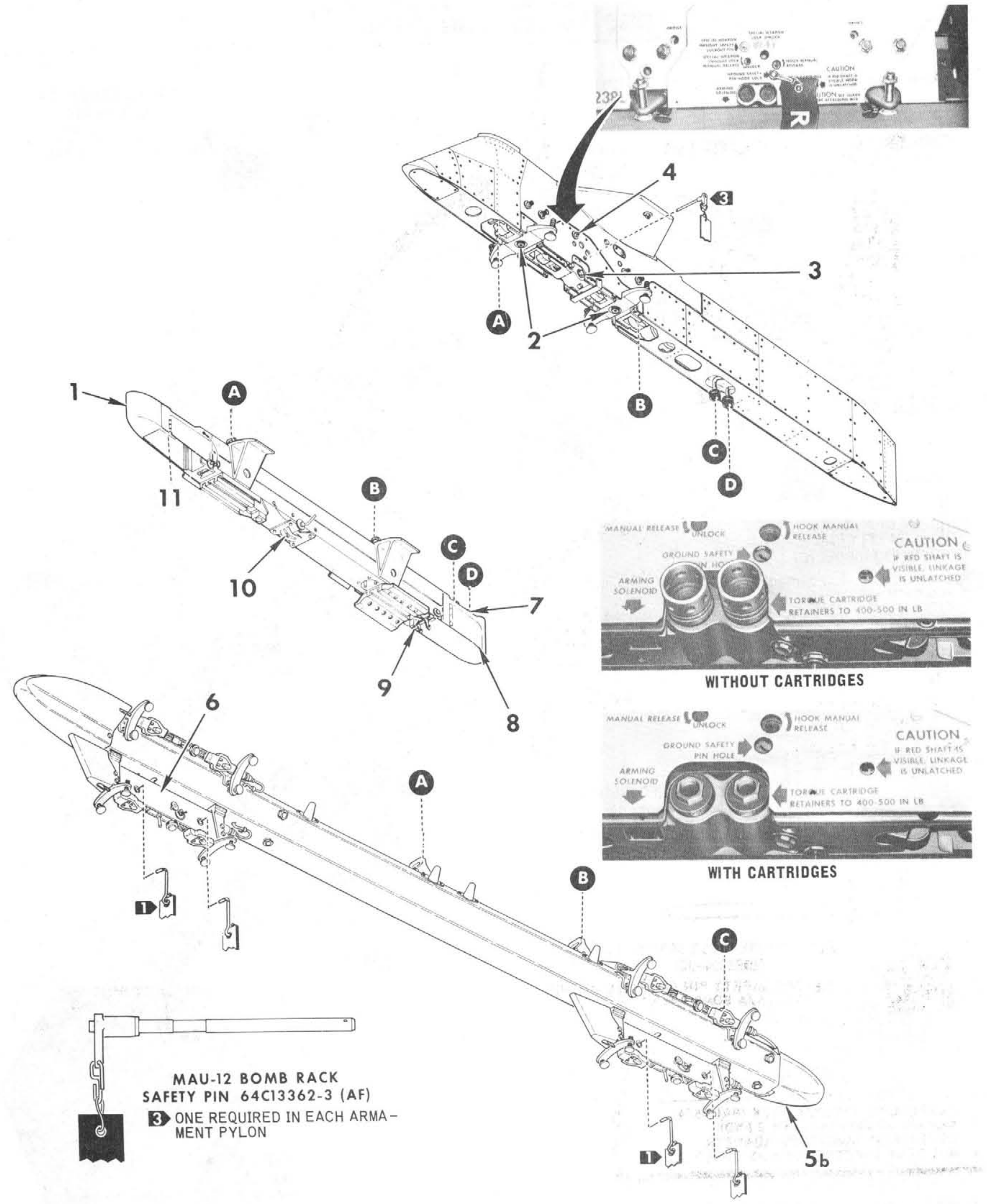
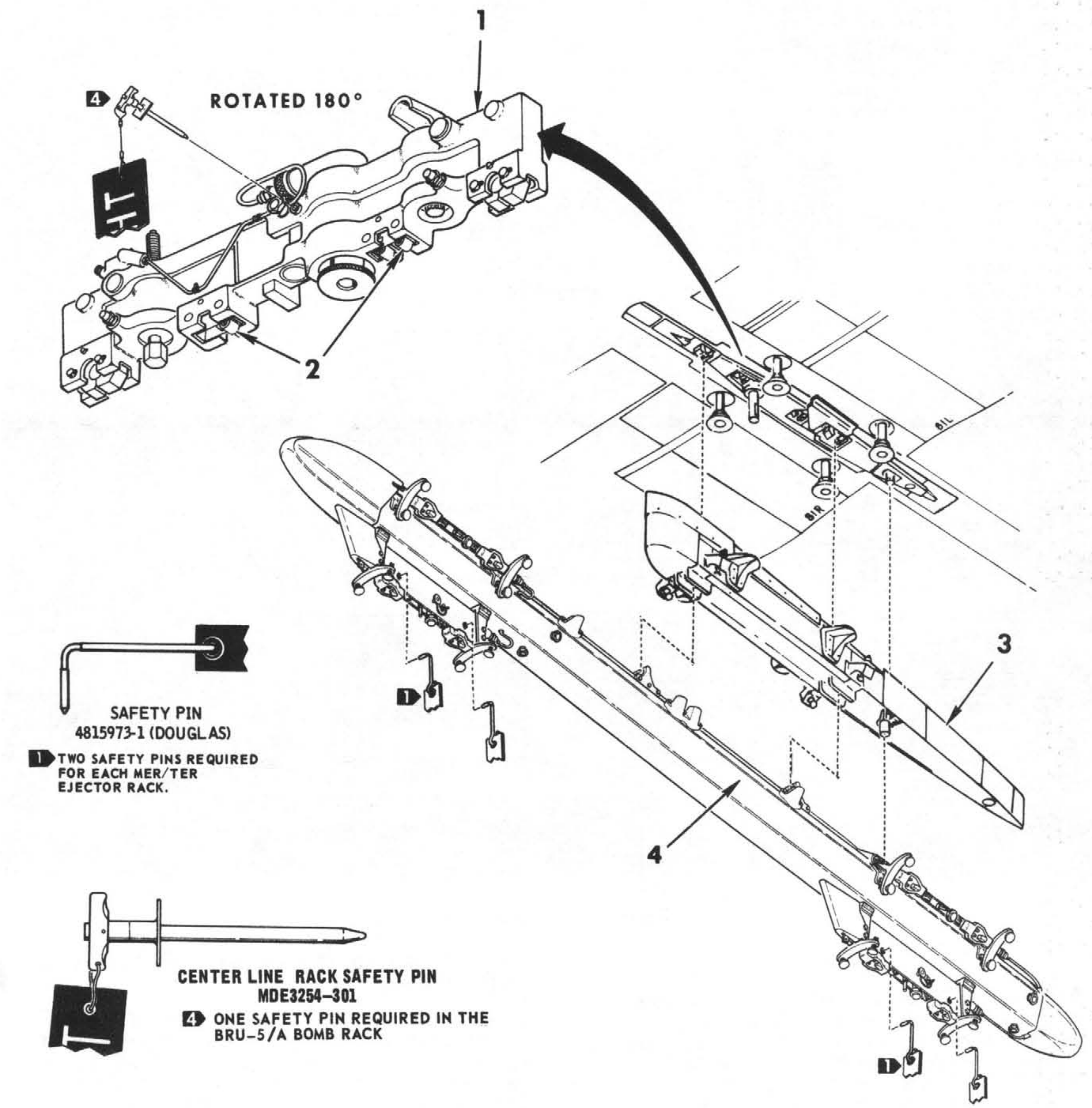


Figure 1-34 (Sheet 2 of 4)

CENTERLINE RACK F-4D



1. CENTERLINE EJECTOR RACK (BRU-5/A)
2. ARMING SOLENOIDS (1 AFT 2 FWD)
3. CENTERLINE BOMB RACK ADAPTER
4. MULTIPLE EJECTOR RACK ASSEMBLY (MER)

F4D-34-1-223-3

Figure 1-34 (Sheet 3 of 4)

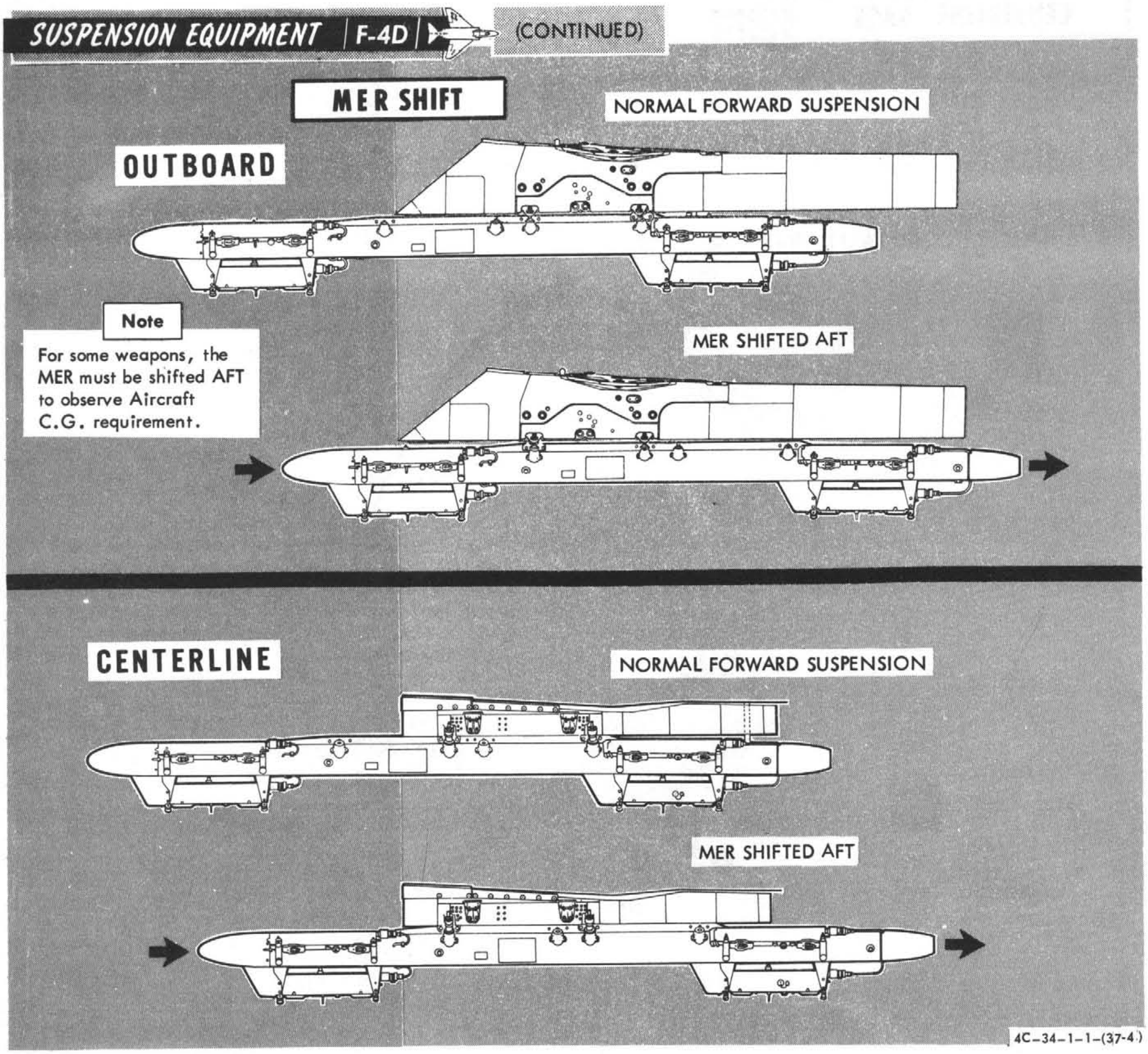


Figure 1-34 (Sheet 4 of 4)

Note

- Do not confuse the *rehoming* procedure performed by the aircrew with the *homing* procedure performed by the load crew. The load crew will position the STEP-OFF-HOMING switch on the MER or TER to HOME and obtain a steady green light. After the load crew has homed the MERs and TERs, the RKTS & DISP position will not move the stepper switch.

- The TER-9A and MER-10A is automatically homed to the first loaded station in sequence each time power (28v dc Ess Bus) is applied to the aircraft. The load crew does not home the MER-10A nor TER-9A.

The following causes of bomb release failure can be corrected in flight by rehoming the MER's and TER's, provided the MER/TER stepper switch has arrived at the OFF position.

a. Improper homing of the MER's or TER's.
b. Moisture in the bomb ejector rack breech that grounds-out the release signal. After the MER's and TER's are rehomed, succeeding release pulses can (in some cases) generate sufficient heat to evaporate the moisture in the bomb ejector rack breech.

The following causes for failure of the bomb release circuit cannot be corrected inflight by rehoming the MER's and TER's:

a. Faulty ejector rack cartridges.
b. Broken or shorted wiring to the ejector rack cartridges.
c. Faulty relays.

If all the bombs carried do not release, the ejector racks should be rehomed and release attempted again. Rehome the MERS and TERS as follows:

a. Weapons selector knob - RKTS & DISP

The weapon selector knob is the only switch necessary to rehome all the MER's and TER's to position the release pulse at the next loaded point of all stations regardless of the station selected. After the remaining switches are set for bomb release, the bomb button is depressed and held for 4 seconds with BOMBS/RIPPLE selected. With the MER-10/TER-9, if the weapon does not release when the arm nose tail switch is in an armed position, rehome and then repeat the BOMBS/RIPPLE release procedure with the arm nose tail switch in SAFE. If the station loaded sensor switch has failed in the station empty position, releasing the weapons safe supplies a release pulse to the loaded stations and the unloaded station.

Note

- The arm nose tail switch position does not affect the operation of the TER-9A, MER-10A stepper switch; the release pulse is directed only to the loaded stations.
- If the bombs cannot be released after performing the preceding procedures, it must be assumed that the ejector rack cartridges will not fire, or that the MER or TER is malfunctioning.

Consider the situation where three rocket launchers are loaded on a TER. The TER stepper switch is on position No. 1. The TER stepper switch has four positions: 1, 2, 3 and OFF. The first loaded point in sequence is referred to as the home position. Assume that the rocket launchers on points one and two have been fired-out and the rocket launcher on point three is full, i.e., no attempt was made to fire the remaining rocket launcher. (The full launcher must be released or fired before the empty launchers can be released.) To release the rocket launchers, the weapon selector knob is positioned to BOMBS. When the bomb button is depressed, a pulse is supplied to release the full rocket launcher on point No. 3. When the bomb button is released, or the firing pulse is ended, the stepper switch moves to OFF. Succeeding pulses will not move stepper switch from OFF. To release the two remaining empty launchers, the weapons selector knob must be positioned to RKTS & DISP. Power is now supplied to the stepper switch to position it to a loaded point; in this case point No. 1. The AC can now select BOMBS and release the two empty dispensers.

In this example, the rocket pods are released from the TER out of normal bomb release sequence, i.e. TER station 3, 1, 2. The normal bomb release sequence is TER station 1, 2, 3 (refer to figure 1-18).

CAUTION

Rocket pods and CBU dispensers (full and empty) should be released from the MER/TER in the normal bomb release sequence to avoid possible aircraft damage.

There is presently no cockpit indication or procedure to ensure which MER/TER station is selected for BOMBS release after RKTS & DISP has been used. The position of the MER/TER stepper switch is established by the number of dispensing signals to the aircraft station and the number of dispensers (or rocket pods) on that station; i.e., the number of dispensing pickle signals to a loaded station must be equal to the number of dispensers loaded on that station (or a multiple of the number of dispensers on that station) prior to selecting BOMBS to release the dispensers/rocket pods from the MER/TER.

The release sequence is more likely to be out of sequence when the outboard, inboard, and centerline aircraft stations are not loaded with the same number of dispensers (or rocket pods) and all aircraft stations are selected for dispensing (RKTS & DISP/SINGLE). For example: assume a configuration of 4 dispensers on each outboard station and dispensers on each inboard station and on the centerline station (17 dispensers total). The inboard and centerline stations should be deactivated after the third dispensing pickle (15 dispensers have been emptied). After the fourth dispensing pickle to the outboard stations, select BOMBS/RIPPLE, and hold the bomb button depressed to release the dispensers from the MER/TER in the normal bomb release sequence.

AERO-7A MISSILE LAUNCHER

Four Aero 7A launchers are mounted in the fuselage so that four AIM-7 missiles are semi-submerged. The Aero 7A launcher (figure 1-35, sheet 1) has two ejector pistons which are operated by gas generating cartridges to eject the missile downward an approximate 8 inches before the missile motor is fired. Each of the forward fuselage stations has a cavity door that closes after the missile is gone, to smooth the contour of the fuselage. Each launcher is electrically and mechanically protected from inadvertent firing of the ejector cartridges by a safety pin which is removed prior to flight.

AERO-7A MISSILE LAUNCHER

AIM-7 MISSILES

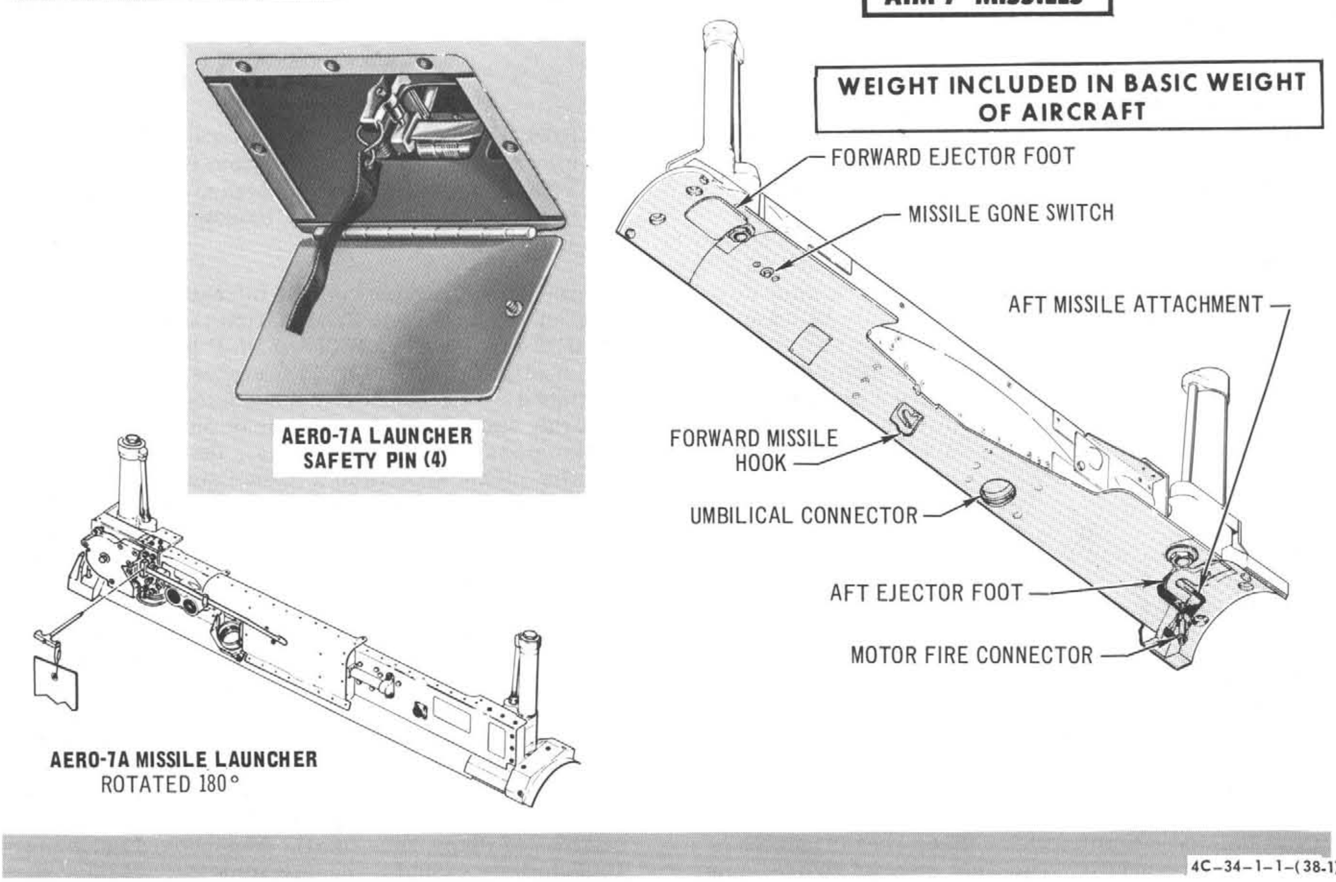


Figure 1-35. (Sheet 1 of 2)

AIM-4D MISSILE LAUNCHERS

(After T.O. 1F-4D-508)

An AIM-4D launcher set group (figure 1-35) consists of the MAU-12B/A armament pylon, the inboard AIM-4D launcher, and the bottom (lower) AIM-4D launcher. The inboard launcher contains all the electrical and electronic gear for both launchers. The inboard launcher is bolted to the inboard side of the MAU-12B/A armament pylon. The bottom launcher is suspended from the MAU-12B/A ejector rack. Ejector cartridges are not installed in the rack. The AIM-4D launchers cannot be jettisoned. Electrical connections for missile pre-launch signals are accomplished through an umbilical connector from the aircraft power source within the pylon. During ground operations, the missile electrical connector is disconnected to prevent inadvertent firing and must be connected prior to flight. The AIM-4D is interlocked with trailing edge flaps to prevent interference during launch. The speed brakes may sustain damage if they are extended during missile launch or jettison.

Note

- After T.O. 11L3-3-5-504, the AIM-4D launcher is modified for AF Standard logic and extended cooling. After this modification, the dash number of the Inboard Launcher is changed from -120 to -130. Refer to T.O. 1F-4C-34-1-1A for additional information.
- After T.O. 11L3-3-5-507, the AIM-4D launcher is modified for simplified launch procedure. After this mod, the launcher is marked with a decal ARM/START LAUNCHER (selecting missile arm starts missile cooling) and the dash number of the launcher is changed to -140. Refer to T.O. 1F-4C-34-1-1A for additional information.

LAU-7A/A MISSILE LAUNCHER

Refer to T.O. 1F-4C-34-1-1A.

AERO-3B MISSILE LAUNCHER

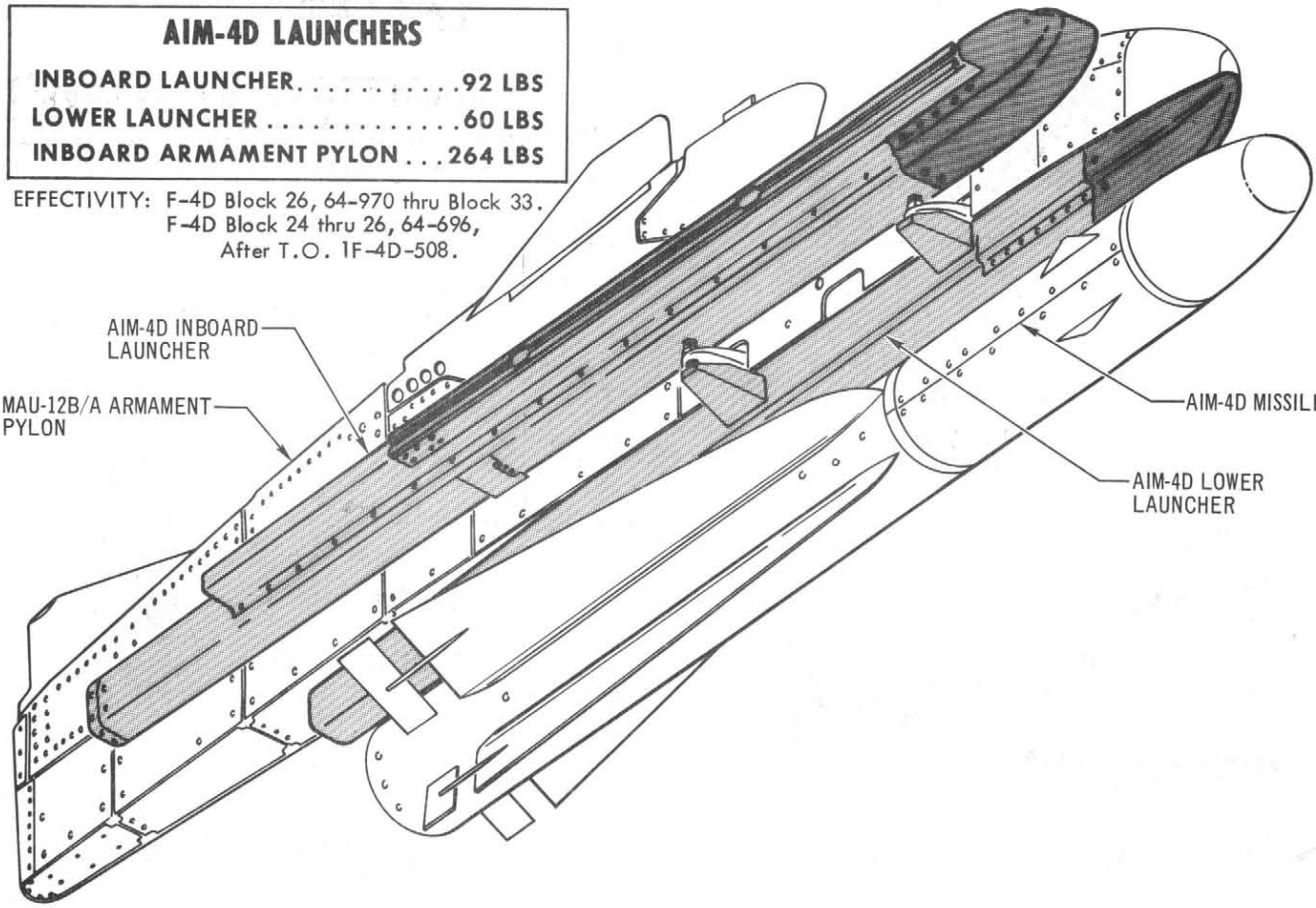
Refer to T.O. 1F-4C-34-1-1A.

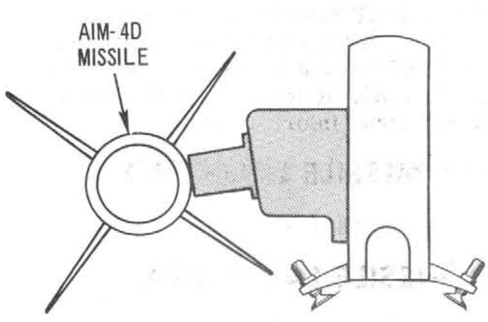
GUIDED MISSILE LAUNCHERS F-4D (CONTINUED)

AIM-4D LAUNCHERS

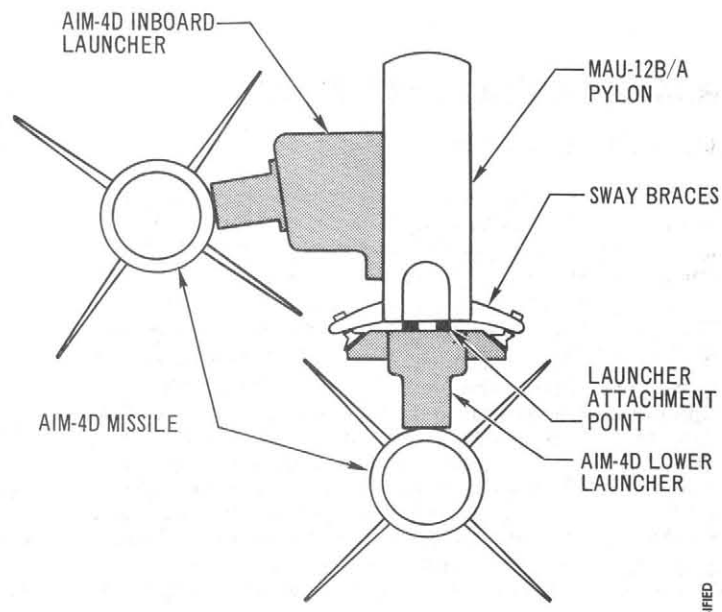
INBOARD LAUNCHER	92 LBS
LOWER LAUNCHER	60 LBS
INBOARD ARMAMENT PYLON	264 LBS

EFFECTIVITY: F-4D Block 26, 64-970 thru Block 33.
F-4D Block 24 thru 26, 64-696,
After T.O. 1F-4D-508.





STATION 2 (FRONT VIEW)
ALTERNATE LOAD CONFIGURATION



STATION 2 (FRONT VIEW)

F4D-34-1-224-2

Figure 1-35. (Sheet 2 of 2)

AGM-12 WEAPON SYSTEM (F-4D THRU BLK 33)

This section describes the AGM-12B/C/E guided missile, launching system, associated equipment, the cockpit controls and controlling procedures.

With respect to missile control and flight operations, the missiles are nearly identical. The AGM-12B and C missiles are both ground burst devices, with the AGM-12C being considerably greater in weight and explosive yield. The AGM-12E is basically the same as the AGM-12C, except the -12E missile is an air-burst, anti-personnel device.

Note

Refer to part 4 of this section for a description of the AGM missiles.

MISSION

The AGM-12 missile and associated equipment provides the radio-controlled, guided missile capability to enhance the air-to-ground strike mission. With the AGM-12 system energized, the AC begins an attack (dive or level) on the target and stabilizes the airplane flight path directly toward the target. The AC attempts to maintain a constant line-of-sight (LOS) with the target throughout the missile run. The missile fire signal is delivered by depressing the bomb button (either cockpit), igniting the missile liquid-fuel engine and the tracking flares. After engine burn-out (approximately 2.0 seconds) the AC begins transmitting steering commands to the missile receiver. The system transmitter emits the r-f signals as the control selector handle is positioned in combinations of left-right or up-down movements. Hence, the AC directs the missile flight path in azimuth and elevation, causing the missile (visible tracking flares) to close on the LOS to the target.

CONFIGURATION AND SUSPENSION

AGM-12B MISSILE

A total of four AGM-12B missiles, one on each wing station, may be carried and launched against tactical ground targets. The inboard and outboard AGM-12B suspension equipment for F-4D aircraft is shown in figure 1-34. Each armament pylon receives the LAU-34/A missile launcher. The branched wire bundle from the armament pylon is attached to both receptacles on the aft end of the launcher. The forward branch powers AGM-12B functions. (The aft branch powers AGM-45 missile functions discussed elsewhere in this section.) In a jettison situation, only the missile is jettisoned. The LAU-34A remains with the aircraft.

AGM-12C AND -12E MISSILES

A total of two AGM-12C or -12E missiles may be carried, one on each inboard station. An AGM-12 relay panel, installed only in the inboard armament pylon, relays the pre-arm and missile fire/release signals from the cockpit. Hence the missile is loaded directly on the pylon (MAU-12B/A) bomb rack. In this case, the fire signal ejects the missile from the rack and the missile engine ignites immediately after ejection. A discussion of AGM-12 missile fire and jettison procedures is provided later in this section.

LAU-34/A LAUNCHER (AGM-12B CARRIAGE)

In general, the launcher (figure 1-34) is responsible for the proper dispersal of pre-heat, pre-arm, and missile fire voltage. When the aircraft main bus system is energized, power is automatically directed to missile components for warm-up purposes and the system transmitter receives standby power. Thus, the system is in a warm-up condition as soon as the main bus system is energized.

When the AC selects the AGM-12 missile on the weapon selector switch, relays in the launcher are energized that unlock the pre-arm and missile fire circuit. As the AC depresses (and holds) the bomb button, the missile battery, gyro, pneumatic control system, and warhead arming circuits are activated. The missile battery builds up to power and closes a relay in the launcher – completing the circuit between the bomb button (depressed) and the liquid engine ignitor. The firing sequence takes approximately 2 seconds. The engine thrust force breaks the shear pin in the forward retention mechanism (figure 1-34) and the missile is free to launch. As the missile separates from the aircraft, the umbilical breakaway connector separates and the missile systems function on battery power.

If the AGM-12B must be jettisoned, the jettison signal energizes a cartridge in the launcher jettison gun assembly. The force of the expanding gas from the cartridge rotates the aft retention mechanism and slides the missile rearward free of the launcher rail. In this case, the missile freefalls in an inert state. Only under the condition of a normal, powered launch will the warhead become armed.

AIRCRAFT COMPONENTS

TRANSMITTER AND CONTROL SELECTOR (AN/ARW-77)

With the aircraft bus system energized, 28 volt dc power is continually applied to the transmitter electron tube filaments, crystal heaters, and voltage regulator. When bomb button voltage is applied at launch, the ARW-77 transmitter signal is initiated and an internal timer (in the transmitter) begins a 50 ± 10 second cycle. The timer sustains transmitter output for the above time period after the AC releases the bomb button. The output signals from the cockpit control selector are converted into command pulses

CONTROL HANDLE vs. CANARD DEFLECTION | F-4D

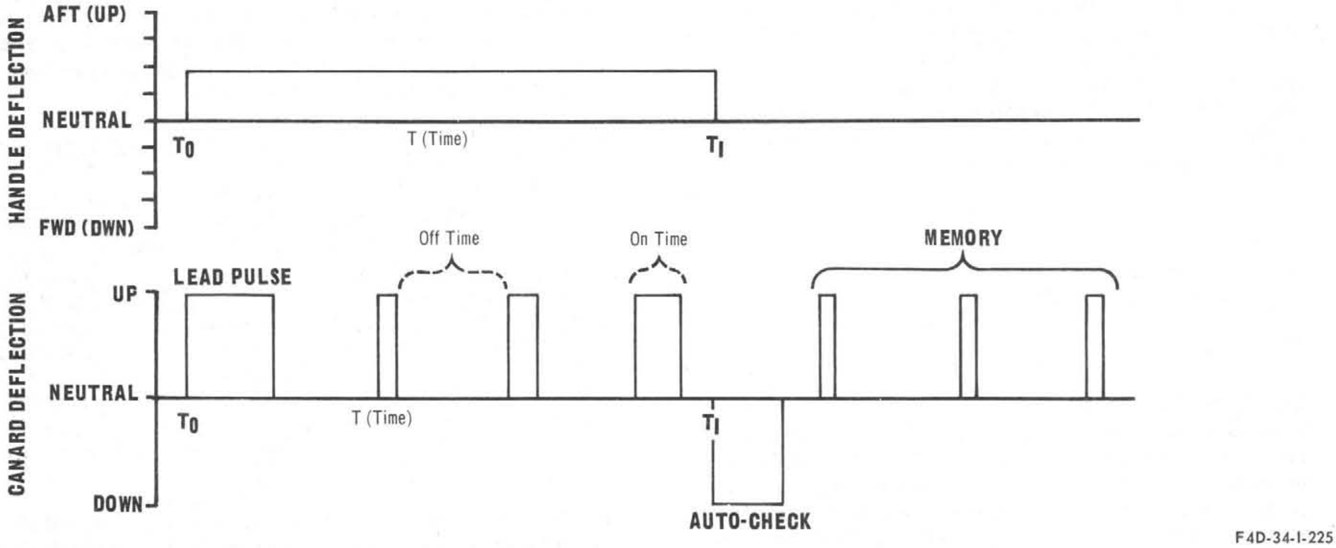


Figure 1-37

by the transmitter. The transmitter circuits code, amplify, and apply the commands to the lower UHF antenna. Any one of the 24 command channels may be used, depending upon the crystal installed in the transmitter. The transmitter crystal assembly installed must match that of the missile receiver.

The control selector (figure 1-38) receives power directly from the transmitter and in turn applies command output voltages to the transmitter circuit. With the control handle in the neutral position, the system continually emits a neutral or reference signal. Movement of the handle causes signal changes with respect to the reference signal. The amount of change is directly proportional to handle displacement. A further discussion of control handle functions and the command link (adaptive control) system is provided below.

Transmitter output to the missile is always emitted through the lower UHF antenna on the nose gear door. Any UHF radio transmission, while the AN/ARW-77 transmitter is in operation, is automatically emitted through the upper UHF antenna, regardless of the antenna switch position (UPR or LWR).

MISSILE CONTROL

ADAPTIVE CONTROL SYSTEM

The features of the adaptive control system may be described by observing the functions of an individual command. These functions (listed below) are directly controlled by AC manipulation of the control handle in the cockpit (figure 1-38).

a. Lead Pulse.
b. Variable Pulse Rate Frequency.
c. Auto-Check Command.
d. Memory Command.

When the AC deflects the control handle providing an input voltage to the transmitter, circuits in the transmitter develop command pulses by repeatedly conducting and then deenergizing, applying and removing voltage for transmitter pulse output. The net result is that the missile canards momentarily deflect and then return to neutral as each pulse is applied, continuing the pulsating deflections as long as the handle is displaced. The canards always deflect fully with each pulse, regardless of the degree of control handle displacement. As an example, assume that the AC – having launched a missile – applies an up correction by moving the handle aft. Further, assume that the stick is deflected about one-half travel at time T_0, and then returned to neutral at time T_1 (figure 1-37). In the figure, off time refers to the time between pulses when the canards are neutral; on time refers to pulse duration, which corresponds to canard deflection time.

Since an up correction is necessary, the missile is low with respect to the LOS and probably going lower due to the effect of gravity. (Also, note that the AGM-12C missile is ejected and not launched, which applies another force component to the missile normal

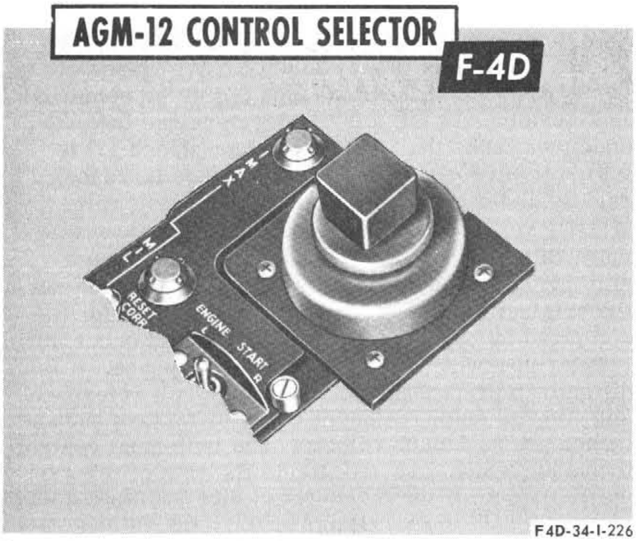


Figure 1-38

to the LOS.) Hence, as the AC moves the stick, the command must initially apply enough energy to rotate the missile axis and change its course, and in some measure account for the time lag in the command link system. The lead pulse, that functions to quicken missile response for the above reasons, is applied for a longer period than subsequent pulses as figure 1-37 indicates. The width, or on time, of the lead pulse is proportional to how rapidly the AC moves (or accelerates) the stick to the desired position. A rapid movement delivers a lead pulse of greater duration than that of a gradual movement. This is in keeping with the natural tendency to correct rapidly if the AC notices a large error developing. Conversely, the lead pulse function points out the necessity of using gradual, smooth, control stick movements in instances where missile steering is extremely sensitive, or where steering errors are small.

As long as the control handle is held in the deflected position, the pulse train continues. After the lead pulse, subsequent pulses are short at first, increasing in duration (time) as the stick is held. This means that the canards are deflected for increasing periods of time with each pulse. If the AC increases the amount of handle deflection, the amount of pulses per unit of time increases, or in other words, the frequency increases. Hence, the pulse rate frequency varies proportionally with the amount of handle displacement. If the handle is displaced to full travel, the pulse is continuous and canard deflection is continuous. This is the same as stating (regarding figure 1-37) that off time decreases and on time increases as handle displacement increases. The idea is that the AC deflects the handle a specific amount for an observed error. Then as the missile is observed to correct toward LOS at a satisfactory rate, handle deflection may be reduced so that the amount of error and command pulses delivered approach a condition of balance. Small random errors are then corrected by slight, smooth handle movement about the neutral position.

As the handle is returned to neutral at time T_1, the automatic check command is delivered. The check pulse performs very nearly the same function as the lead pulse, but the situation is reversed. As the missile corrects and approaches the LOS, a force must be applied to rotate and align the missile axis with the LOS -- preventing overshoot. Just as the lead pulse, the pulse duration of the check command is proportional to the rate of handle movement to neutral. If the AC notices an overly rapid rate of closure with the LOS, he would naturally return the handle to neutral at a rapid rate. Thus, the AC is able to reduce lateral or vertical acceleration without handle deflection in the opposite direction.

After control handle voltage is removed, the system automatically generates small memory commands at a constant rate. These commands will continue throughout missile flight unless they are countered by stick movement in the opposite direction. The frequency of the memory commands is a function of the amount and duration of the initial handle displacement. A small handle deflection held for a long duration can develop the same memory as a large handle deflection held for a short duration. The memory circuits function to aid in overcoming natural forces continually acting on the missile. In the example command cited here, the up memory would serve to compensate for further gravity drop.

In view of the above, one can visualize the system when handle movements are made in directions other than the cardinal ones. If the handle is moved to deliver an up-right command for example, the command sequence in figure 1-37 is applied in both up and right directions simultaneously. The point to be made is that the AC need not restrict control movement to cardinal directions only, but may use combinations of the cardinal commands and vary their magnitude.

CONTROL CONSIDERATIONS

The above discussion treats the system somewhat ideally for purposes of demonstration. In practice, there are several more things to consider. The AC must establish the desired LOS with the wings level, applying enough forward trim to counteract the tendency for the nose of the aircraft to rotate as velocity during the dive increases. Remember that the missile gyro is uncaged while the missile is still on the launcher, and that the gyro establishes a vertical reference relative to the position of the aircraft. Thus, if the aircraft is in a 45° left bank at launch and subsequently rolled level after launch, an up-command will result in the missile steering up-left.

When firing the liquid engine, the missile is plainly visible at launch. Engine burnout is identified by a puff of white smoke. The AC must ensure no commands are issued until after engine burnout. The AC will obtain best results if he can avoid the natural tendency to fix his vision on the missile flares after launch. Rather, keep the eyes fixed on the target (or impact point of the target) and view the missile flares through the peripheral vision. The picture is similar to the pipper light floating on the wind screen. This procedure will help maintain a steady LOS.

In most cases, the missile appears below the target and to the left or right, depending upon the wing station used. If the missile is low, the first feasible command is the up command to initiate the upward correction, and to help counteract further sink due to gravity by establishing up memory. At the lower release angles, the effect of gravity will be greater. If the missile is initially high before any commands are issued, allow gravity to correct the elevation error. A down command with down memory, plus the effect of gravity, is sure to result in overshoot below the LOS. With all systems functioning normally, the command link system is most sensitive during the first few seconds after engine burnout. Hence, use smooth control action to establish a desirable corrective *trend* toward LOS, rather than attempting to eliminate all sources of error immediately. Missile steering tendencies will vary; that is, some missiles will be more sensitive than others. When applying the initial command, however, all missiles should be regarded as *very* sensitive; it is easier to add more handle displacement than to correct an over-controlled missile.

The AC can get an idea of how much handle deflection is needed by observing missile trend. To illustrate, suppose the flares are observed to move from left to right toward the LOS at a rapid rate. At the instant the flares move into and conicide with the LOS, the apparent error is zero; but the error trend remains very large since the angle between the missile axis (or flight path) and the LOS is relatively large. In this case, considerable control movement, with proper lead, would be necessary to avoid overshoot. However, if the missile is considerably wide by generally holding position relative to the LOS, the missile axis may be considered to be nearly parallel to the LOS. In this case, a lesser control deflection is necessary to divert the missile and the AC uses smooth control input, varying handle deflection only to establish a controllable correction rate.

If the missile can be established at a point close (and parallel) to the LOS early in flight, there should never be any need for large, rapid, control handle movements. In fact, during the early phase of missile flight, the AC will usually have to use conscious effort to avoid overcontrol. With the adaptive system, a small degree of handle displacement held for a longer time produces the same effect as a full deflection for a very short interval. The former is by far the more desirable, however, since the trend of missile correction is more easily judged. The continuing effect of gravity must be kept in mind, and possibly used to an advantage. As dive angle increases that component of gravity that tends to pull the missile down from the LOS becomes less. However, if the missile steers slightly high, up memory will probably not be sufficient to continually hold the missile high and gravity may be used to make the necessary correction. The AC must avoid anticipating the impact, and continually fly the missile until impact is observed.

Roll Reference Shift

The description of the AGM-12 gyro system (part 4) points out that at supersonic velocity, the missile roll rate is an average 500° per second. Further, the pickoff brushes in the missile gyro are biased 50° to compensate for 0.1 second time lag in the command link system. As the missile decelerates, however, and approaches the transonic region (Mach 1.1 to 0.9), the lift force at the bent wing tips increases rapidly and causes a rapid increase in roll rate. Missile roll can increase to an approximate maximum rate of 1000° per second. Thus, maximum shift becomes approximately 100° which means that the original 50° bias no longer compensates for the command lag and missile response would occur 50° counterclockwise from the desired response. It is difficult to predict the point at which roll reference shift begins since one must consider factors such as launch angle, launch velocity, and individual control technique which directly effects the rate of missile deceleration. If the technique of steering the missile along the LOS is executed properly, the buildup rate of roll reference is very slow and actual observance of the shift phenomenon is impossible.

A rule-of-thumb method has been devised that -- knowing a desired time of flight (T_f) -- may be used to determine launch altitude (AGL) for a specific dive angle. The method makes use of a factor which corresponds to a specific T_f as follows:

Factor	T_f
0.3	10 sec.
0.4	15 sec.
0.5	20 sec.
0.6	25 sec.
0.7	30 sec.

For example, assume the AC begins the dive on target, establishes LOS, and observes the dive angle to be 35°. If the 20 sec. T_f is planned, the factor of 0.5 is applied (above) so that launch altitude (AGL) is:

0.5 x 35° dive = 17.5 thousand feet AGL.

If target altitude is 1500 feet MSL, indicated launch altitude becomes:

17.5 +1.5 = 19.0 thousand feet.

The above method is accurate (AGM-12B missiles) within ± 2 seconds for dive angles with 15° and 45°, and launch airspeeds between 300 and 600 KTAS.

Offset Deliveries

All previous considerations stated apply to offset deliveries. In this delivery, the LOS continually rotates. For example, if the target is approximately 10° right at launch, it may move to a relative position of 40° right at impact. In view of the shift phenomenon discussed, the target must always be offset to the right. In a shift environment, a right command would result in an up-right response, a relatively easy situation to control. A left command, however, would result in a down-left response, which is nearly impossible to control in an offset mode. In any delivery situation, the rate of LOS rotation can be reduced by reducing airspeed to as low a rate as the situation permits.

COCKPIT CONTROLS

The F-4D aircraft pedestal panel is shown in figure 1-17. The switches provide the individual station select capability. The following discussion considers all AGM-12 missile functions.

WEAPON SELECTOR KNOB

On the pedestal panel, the AC selects the AGM-12 position with either missile above. This selects the required firing system by closing relays in the launcher (AGM-12B) or in the inboard pylon AGM-12C relay panel. In this function, the intervalometer is placed in a singles output mode so that missile fire voltage is directed only to the selected wing station. Finally, selecting AGM-12 closes one portion of the transmitter-activate circuit; the transmitter may be tested after energizing the master arm switch.

MASTER ARM SWITCH

Placing the master arm switch to ARM energizes the bomb button transfer relays, which will direct bomb button voltage into the conventional weapons circuits. The transfer relays will not energize, however, if any of the special weapons release relays (5) are energized. Thus, either the DCU-94/A master release lock, or the station select (all 5), or the consent switch must be off. Selecting ARM immediately closes the bomb button/transmitter-activate circuit. If, at this point, the AC depresses the bomb button, the system transmitter begins the 50 ± 10 second cycle. Hence this method may be used to test (while airborne) the aircraft portion of the command link system. The station select buttons must remain off to avoid firing the armament.

Note

- For transmitter ground test purposes, a Gam-Aux switch is located in the nose wheel well.
- To perform any AGM-12 functions that are executed through the bomb button, the delivery mode selector must be positioned on DIRECT.
- The Good Guidance Monitor (GGM) performs a safing function in the AGM-12E fuzing system (refer to section 4 of T.O. 1F-4C-34-1-1A). In F-4D aircraft, the function is activated during missile flight by pulling the armament power circuit breaker (6E), No. 2 panel in the rear cockpit. (See T.O. 1F-4C-2-18A.) Pulling this circuit breaker deenergizes AN/ARW-77 transmitter output.

STATION SELECT BUTTONS

These controls (figure 1-17) are pushbutton switches containing green and amber indicator lights inside the button housing. The green light simply indicates that a specific button has been depressed. Therefore, if one or more buttons are on, the green light(s) will illuminate immediately as the ac bus system is energized. Both lights are tested through the test control on the right console.

Each button selects a specific station by energizing the corresponding station select relay, which must be energized to get launch voltage to the missile. The amber light, however, serves several purposes. With a specific button depressed, the light indicates:

1. That the pylon wire bundles are properly installed for the specific station selected. In the case of the AGM-12B, the light indicates that the LAU-34/A launcher bundle is plugged into the proper pylon receptacle. With the AGM-12C and -12E aboard, the light indicates that the AGM-12C relay panel is properly connected into the aircraft/AGM-12 circuits.
2. That the station select relay is closed, which connects bomb button output to missile launch circuits.
3. That the master arm switch is positioned to ARM, which closes another interlock in the bomb button circuit.

Thus, the amber light simply indicates that the aircraft is properly configured for the weapon selected, and provides a complete launch-ready signal. When the bomb button is depressed, launch voltage is directed through each station relay in the following order:

1. Left OUTBD (LO)
2. Left INBD (LI)
3. CL
4. Right INBD (RI)
5. Right OUTBD (RO)

In order to fire an AGM-12B missile from the RO station, all of the other station select switches must be off. To fire the LI station missile, only the LO station must be off. The CL button is included even though this station is not AGM-12 capable. This merely points out that it is impractical to energize all stations at once with several AGM-12 missiles aboard. Rather than commit the above order to memory, the AC may simply select one station at a time, and after firing the selected missile, place that station off before selecting the next.

JETTISON CONTROLS

The AGM-12C or -12E missile is jettisoned (ejected) directly from the MAU-12 rack in the armament pylon. The AGM-12B missile is jettisoned (kicked) rearward by the LAU-34/A launcher jettison gun assembly.

PART 3 DESCRIPTION F-4E

TABLE OF CONTENTS

MISSION DESCRIPTION (F-4E)

DIVE BOMBING

Dive bombing with the F-4E aircraft can be performed with the aid of the weapons release computer set (WRCS), or by the DIRECT release mode. The WRCS delivery mode normally associated with the dive bombing mission is the DIVE TOSS bombing mode (figure 1-39). When the DIVE TOSS bombing mode is used, the weapons release computer solves the bomb ballistics problem for various release speeds, altitudes, and dive angles, and automatically releases the bomb. Therefore, mission planning is reduced to obtaining the drag coefficient of the bomb and determining a safe recovery altitude. Wind correction for the low drag bombs is normally not required. Refer to wind correction.

Note

Neutral rudder trim should be accomplished at the planned delivery speed. Since the turn and slip indicator in the aft cockpit is more sensitive, the pilot should assist the AC by calling the indicator display.

For any given dive angle, the bombing tables in T.O. 1F-4C-34-1-2 assume a normal G-loading which can be obtained only when a wings-level, straight line flight path is maintained prior to release. The pipper should be allowed to walk toward the target or aimpoint and should arrive when the aircraft is at the release altitude and airspeed. The roll tabs on the optical sight should be used to maintain wings-level flight. If radar lockon can be obtained, the range bar may be used to establish the slant range.

DIRECT BOMB MODE

Several factors must be considered when determining an indicated release altitude: altimeter position error altitude loss during pullout, minimum aircraft ground clearance; altimeter lag; and target elevation. The altimeter is set according to target pressure reduced to sea level (target altimeter setting). Immediately following bomb release, a 4 G pullout is initiated. The acceleration rate is 4 G obtained 2 seconds after release. If buffeting is encountered, the buffet boundary is maintained until the desired climb attitude is obtained. When the DIRECT delivery mode is used, mission planning becomes more detailed. The dive bombing tables provide trajectory data for the various parameters associated with the delivery. Consistency in the all-important roll-in parameter cannot be overemphasized. The parameters of altitude, airspeed, distance from target, and power setting are preplanned to place the aircraft at a predetermined release altitude and distance from target, with a predetermined bomb release velocity and attitude to effect an accurate hit. Because of the longer periods of wind effect on the trajectory of the bomb, it is also important that the aircrew have knowledge of the magnitude of wind effect and, primarily, the wind velocity at release altitude.

Selecting the direct delivery mode enables the lead computing optical sight to be used as a fixed sight reference that can be depressed from zero mils to 245 mils below the fuselage reference line. The actual sight setting is obtained by adding the aircraft zero sightline angle of attack to the value obtained in the bombing tables (T.O. 1F-4C-34-1-2). The optical sight is used in conjunction with the altimeter, and the calibrated airspeed indicator to determine the release point.

ROCKET LAUNCH

The DIRECT delivery mode is used to fire the 2.75-inch folding fin aircraft rocket (FFAR). The optical sight is operated in the A/G mode. The sight depression angles are presented in the rocket launch tables as a function of angle of attack rather than the depression angle from flight path. Only the RKTS & DISP SINGLE position should be used when firing the rocket launchers to ensure complete fire-out of all rockets.

Note

If RKTS & DISP RIPPLE is selected, the launcher will not fire-out completely because the firing pulse from the aircraft intervalometer is not of sufficient length to completely fire-out the launcher intervalometer.

Fuze arming is not a consideration for rocket launch except when using the WDU-4A/A Flechette Warhead; refer to the confidential supplement for release considerations, section V. Safe escape considerations are somewhat different in that the aircraft is flying toward the frag envelope and possible secondary explosions from the target. The safe escape tables in section VI do not consider terrain avoidance nor secondary target explosions. The effect of wind is less than for bombs because of the shorter time of flight. The rocket launch tables presented in T.O. 1F-4C-34-1-2 are valid for all rocket launchers and type of suspension equipment used. Separate launch tables are required for the various categories of warhead used with the 2.75-inch rocket motor.

GUN FIRING

When firing the SUU-16/A gun pod or the M61A1 nose gun in an air-to-ground environment, either the OFF or DIRECT position should be selected on the delivery mode selector panel to orient the optical sight with the fuselage reference line (refer to optical sight functions, figure 1-48). Safe escape considerations when firing the 20mm gun must include terrain avoidance, ricochet, and secondary target explosions. The delivery considerations for firing upon a ground target are generally the same as for bombing and rocket firing. Wind and sight depression corrections is less because of the projectile shorter time of

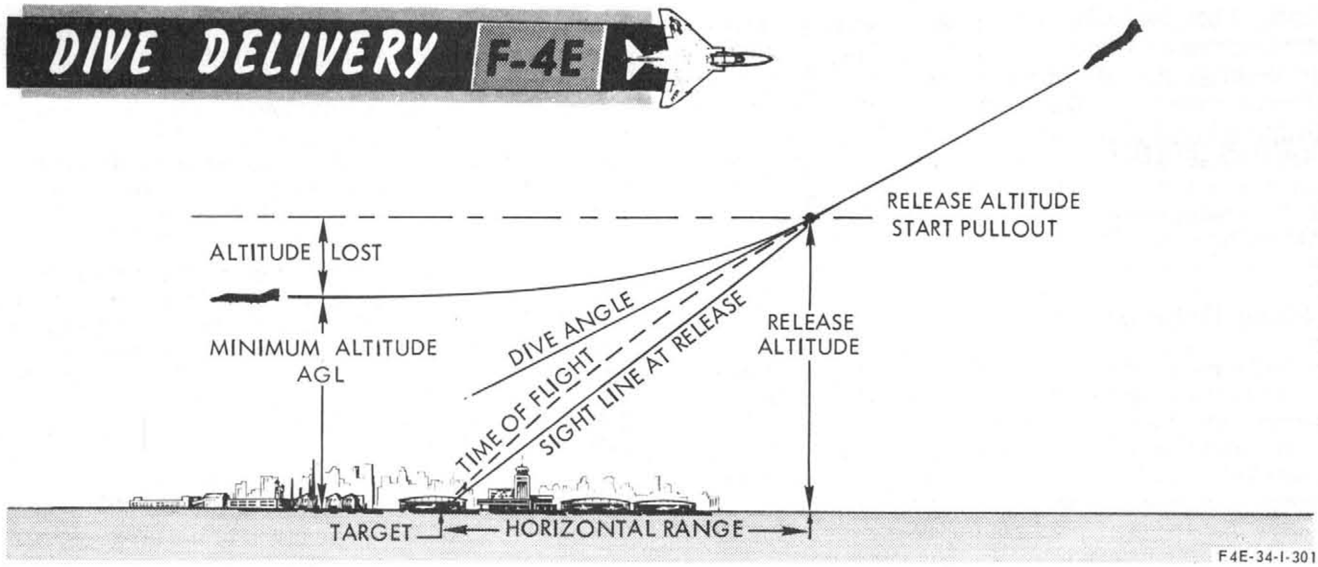


Figure 1-39

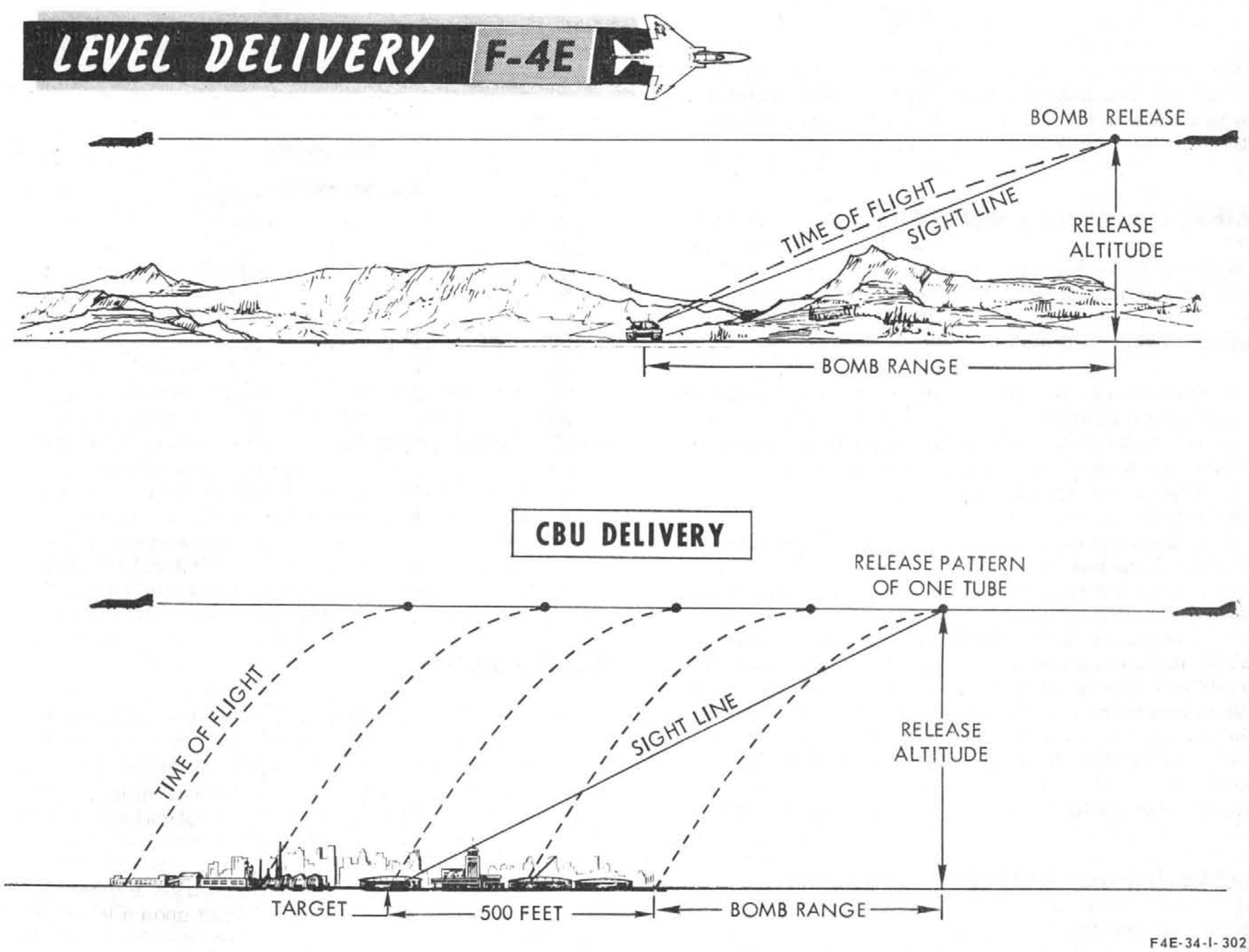


Figure 1-40

flight. Like the rocket launch tables, the sight setting is given as a function of gross weight. Refer to the description of the SUU-16/A gun pod and the 20mm ammunition. When firing the guns in air-to-air gunnery, the lead computing optical sight set (AN/ASG-26) functions to position the sight reticle in azimuth and elevation and satisfy the geometry of a lead pursuit course. (Refer to Air-to-Air Gunnery, this section.)

LEVEL BOMBING

Level bombing (figure 1-40) is a special case of dive bombing where the dive angle is zero; the delivery parameters are basically the same. The approach to the target is performed at a constant altitude, wings level, and at a stabilized airspeed. After bomb release, the aircraft may continue the approach course and speed or perform the required escape maneuver. The weapons release computer set (WRCS) provides a variety of delivery modes that can be used for level bombing; dive toss (dive-level maneuver), dive laydown, laydown, or offset bombing. Refer to Weapon Delivery Modes this section. The most sensitive parameters that affect bombing accuracy are the release altitude above target and pitch attitude. Refer to Altimeter Position Error, section V. The method used to correct for wind effects is determined by the method of target tracking (crabbed or drifting) and the type of weapon (high drag or low drag). Refer to Wind Correction, section V.

RIPPLE RELEASE BOMBING

Ripple release bombing tables are provided in T.O. 1F-4C-34-1-2. Ripple release (figure 1-41) (dive or level) delivery is identical to the single release with the following additions:

a. Safe escape and dive recovery must be based on the release altitude of the last bomb.
b. The sight setting or bomb range is computed to place the center of the impact pattern on target.
c. Wind correction is based on the time-of-fall of the first bomb released.
d. The minimum release altitude for a level ripple release is based on a straight ahead escape.
e. During the ripple release, a straight line flight path must be maintained. The pipper will pass beyond the target during the ripple release. (The first bomb is released when the pipper is on target.)

When bombs are ripple released (BOMBS TRIPLE mode), the release advance control can be used with one of the WRCS delivery modes to place the center bomb on target. The release parameters are computed for a single bomb release.

LOW DRAG BOMB DELIVERY

Level bombing tables are provided in T.O. 1F-4C-34-1-2. Lower release altitudes can be used (i.e., 500 feet) if full military power is selected and a 4.0-G pullup is initiated immediately after bomb release to attain a 20° to 30° climbing attitude. Refer to Safe Escape, section V. Crosswind correction is not required if the aircraft is crabbed to maintain a ground track through the target. Rangewind correction is not required if the bomb is released at a ground speed that is equal to the preplanned true airspeed. Refer to Wind Correction, section V.

Dive bombing tables are provided in T.O. 1F-4C-34-1-2 for all the low drag bombs and the practice bombs. Refer to safe escape, the fuze arming charts, and the dive recovery chart to determine the minimum release altitudes.

FIRE BOMB DELIVERY

Level bombing and dive bombing tables are provided in T.O. 1F-4C-34-1-2 with dive angle from 0° to 45°. The sight depression angle given in the tables is computed to place the fire bomb on target; when it is desirable for the fire bomb to hit short of the target, the distance must be estimated or the sight setting recomputed using the sight depression charts in section VI. Wind corrections can be applied in the same manner as for the low drag bombs. Refer to wind correction, section V. The dive recovery charts must be used to determine the minimum release altitude.

WARNING

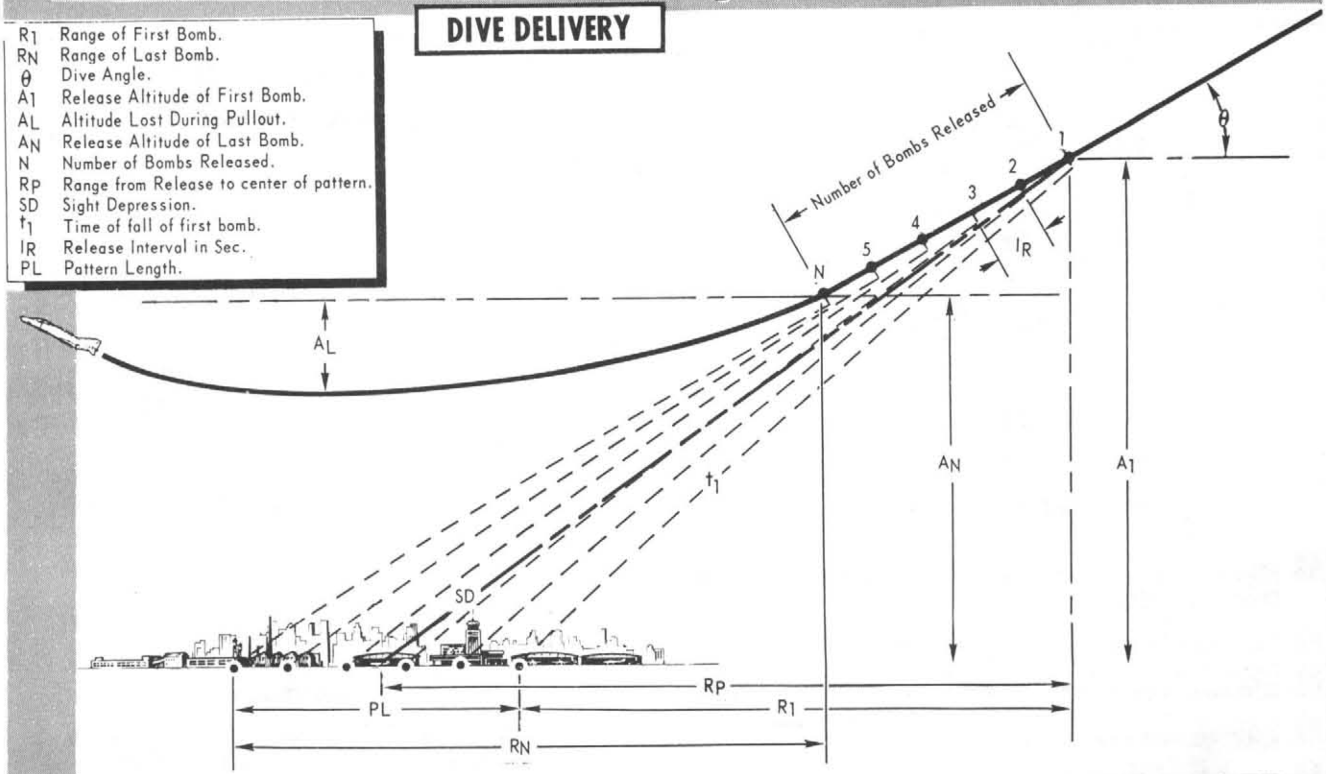
DO NOT FLY through FIRE BOMB SMOKE within 20 seconds of burst as a compressor stall or flameout could occur.

CBU DELIVERY

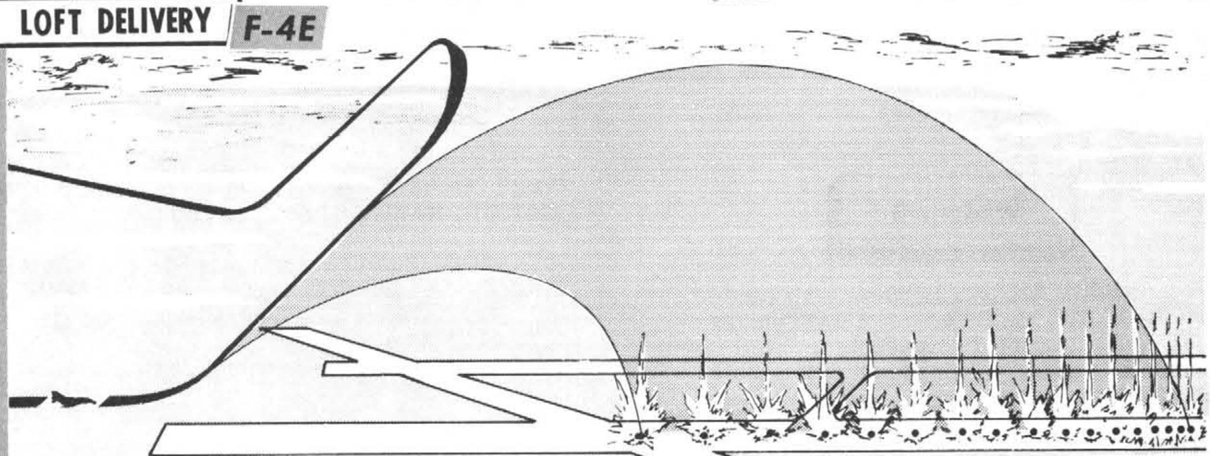
The direct, dive laydown, laydown, or the offset bombing delivery mode may be used to deliver the CBU munition with either a single release or ripple release. Low-level bombing, using the CBU munition consists of a low-level or low-angle approach to target at the predetermined speed and altitude above target. Crosswind correction is applied (in addition to crabbing the aircraft) by offsetting the flight path parallel to, and upwind of the no-wind ground track. Flight path offset, to correct for crosswind, is required by the high-drag CBU munition because of its longer time of flight. The optical sight establishes the release point when the direct delivery mode is used. The release point is automatically computed and release is automatically initiated by the weapon release computer set when the dive laydown, laydown, or offset bombing mode is used to deliver the CBU munition. Rangewind correction may be ignored for the CBU delivery. The bombing tables provide the sight depression angle from flight path that will place the first bomblet 500 feet short of the target. When it is desirable to change the impact point of the first bomb, the sight depression charts in section VI, must be used to establish the sight depression from flight path.

RIPPLE RELEASE F-4E

DIVE DELIVERY



LOFT DELIVERY F-4E

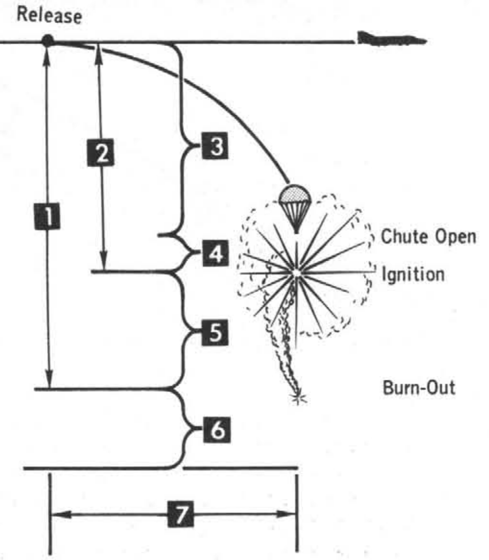


1. PRIOR TO TRP, SELECT LOFT DELIVERY MODE AND SET UP THE MULTIPLE WEAPON RELEASE MODE.
2. WHEN OVER TRP, THE AC DEPRESSES AND HOLDS THE BOMB RELEASE BUTTON TO START THE PULLUP TIMER, THE PULLUP LIGHT WILL ILLUMINATE AND THE HORIZONTAL AND VERTICAL POINTERS ON THE ADI WILL CENTER.
3. WHEN THE STEADY TONE SOUNDS AND THE PULLUP LIGHT GOES OUT, ADVANCE THROTTLES TO FULL MIL POWER AND BEGIN PULLUP. FLY TO KEEP ADI POINTERS CENTERED UNTIL BUFFET ONSET, THEN FOLLOW BUFFET BOUNDARY.
4. WHEN THE SELECTED RELEASE ANGLE IS ACHIEVED, THE PULLUP LIGHT WILL ILLUMINATE, AND THE STEADY TONE WILL STOP. THE AC WILL CONTINUE TO HOLD THE BOMB RELEASE BUTTON DEPRESSED UNTIL THE LAST BOMB IS RELEASED.
5. WHEN THE LAST BOMB IS RELEASED, INITIATE A WINGOVER TO ACHIEVE A 120 DEGREE TURN WHILE DIVING TO ESCAPE AT MINIMUM ALTITUDE.

F4E-34-1-303

Figure 1-41

MK 24 FLARE PROFILE



1. Minimum release altitude AGL required to provide flare burnout.
2. Vertical drop prior to flare ignition.
3. Ejection fuze delay time.
4. Ignition fuze delay time.
5. Flare Burning Time:
   a. Mod 3: 180 sec.
   b. Mod 4: 198 sec.
6. Desired flare burnout height AGL.
7. Horizontal flare travel prior to ignition.

4C-34-1-1-(44)

Figure 1-42

WARNING

When the dive delivery is used, a straight line flight path should be maintained during the release and for 2 seconds after the release; the minimum release altitude should be planned accordingly.

CBU DELIVERY USING THE SUU-7 DISPENSER

When a dive delivery is used for CBU series weapons using the SUU-7 dispenser, a straight line flight path should be maintained during the release and for 2 seconds after release. The minimum release altitude should be based on altitude lost during recovery plus altitude lost during the 2-second stabilized dive after release. This procedure is necessary to prevent voids in the bomb impact pattern whether using dispensers with or without modified tube extensions. The above procedure must be used when the dispenser is not modified with tube extensions to prevent bomb hang-up and possible subsequent early detonations.

WARNING

Do not release bombs from unmodified SUU-7 dispensers (without tube extensions) while the aircraft is in other than wings level stabilized flight.

HIGH DRAG GP BOMB DELIVERY

The high drag GP bombs can be delivered from altitudes between 100 feet to 3000 feet depending upon the bomb used, the fuzing limitation, fragmentation envelope and dive angle. The high drag characteristic provided by the retarder tail fin assembly reduces the bomb range and increases the bomb time of fall and impact angle. Single release and ripple release bombing tables are provided in T.O. 1F-4C-34-1-2.

WARNING

DO NOT FLY over or near burst area within 20 seconds of detonation as aircraft damage can result from flying debris. During training missions, at least 20-seconds spacing between aircraft must be observed when inert or sand filled bombs are released. In the training situation, observing the 20-second spacing between aircraft prevents a bomb-to-aircraft collision in the event a bomb releases low drag and ricochets into the air after impact.

MK82 (SNAKEYE I) AND M117R HIGH/LOW DRAG OPTION, IN-FLIGHT SELECTIVITY

The MK 82 (Snakeye I) and M117R GP bombs can be released in a low drag configuration (retarding fins remain closed) or a high drag configuration (retarding fins open after release) provided arming wire routing is accomplished during loading to provide these options. The high or low drag configuration is selected in flight through the arm nose tail switch on the multiple weapons control panel. Refer to Arming Wire/Lanyard Routing, part 4, for detailed information concerning the required arming wire configuration for this capability.

For a *high drag* release using the in-flight option, the *NOSE & TAIL* position is selected on the arm nose tail switch. The *NOSE* position is selected for a *low drag* release with only the nose fuze initiated. After T.O. 1F-4-805, the *TAIL* position may be selected for a *high drag* release with only the tail fuze initiated.

WARNING

Since certain mechanical and human errors inherent with this type delivery option can result in hazardous or degraded reliability situations, the operational commander should consider the following notes and warnings which point out the possibility of self inflicted damage, injury to friendly ground forces, single fuze reliability, and delivery accuracy degradation before approving this option for operational use.

Note

With the approved arming wire routing for the in-flight high/low drag option, single fuze reliability (nose fuze only) is available with the low drag option. Dual fuzing reliability (nose and tail) is available with the retarded high drag option if the high drag bomb time of fall exceeds 6.6 seconds. If the high drag bomb time of fall is less then 6.6 seconds, only FMU-54 tail fuze arming is available. Single fuze reliability (tail fuze only) is available with the high drag option when the arm nose tail switch is positioned to TAIL.

WARNING

- When the MK 82 Snakeye I or M117R bombs are configured for inflight selectivity for high/low drag releases, the minimum nose fuze setting is 6.0 seconds for the M904E2 or M904E3 fuze; the minimum tail fuze setting for the FMU-54 fuze is 2.5 seconds. With current arming time tolerances, the minimum bomb time of fall to provide time for the fuzes to arm is 6.6 seconds for the nose fuzes and 2.8 seconds for the tail fuze (high drag arming only).
- Under combat conditions, where a 6 second nose fuze arming delay setting may be inconsistent with operational requirements, a 4 second M904E2/E3 nose fuze arming delay setting may be used subject to the following restrictions:
- Dive Releases. For planned high drag dive releases, the release altitude must not exceed 1000 ft AGL.
- WRCS Dive-Toss Releases. For planned high drag dive toss releases, the pickle altitude must not exceed 1000 ft AGL.
- Level Releases. For planned level releases of high drag weapons and a straight and level escape maneuver, the release altitude must not exceed 250 ft AGL. This restriction does not apply for a single, pairs, and salvo type release if a 4G wings level pullup or a 4G 60° banked turn escape maneuver is executed immediately after release.

Note

None of the foregoing restrictions apply if the planned high drag bomb release altitudes exceed the minimum release altitudes that are required for safe escape for low drag MK 82 bombs.

WARNING

- With this in-flight option of high/low drag selection, strict adherence to the prescribed cockpit switchology is mandatory. If the AC inadvertently selects high drag, or experiences an arming solenoid malfunction when the intent is to release a low drag bomb, a fully armed high drag bomb would impact considerably short of the intended aimpoint. If friendlies are in the immediate area, this could result in disastrous consequences. Conversely, if the AC inadvertently selects low drag, or experiences an arming solenoid malfunction when the intent is to release a high drag bomb during close-in attack conditions, the result (if the bomb time of fall is less than 6.6 seconds) would be an unarmed bomb with an initial impact considerably downrange of the intended impact point. This could also result in disastrous consequences if friendlies are in the area; particularly if the bomb detonates, or ricochetes and then detonates. If the bomb time of fall exceeds 6.6 seconds in this case, a fully armed low drag bomb would impact considerably downrange from the intended impact point.
- There is also a possibility of the delivery aircraft suffering self-inflected fragment damage if an intended high drag bomb releases low drag during a close-in attack condition, and for some reason detonated at initial impact. To provide an additional margin of safety in this event, the pilot should execute a 4-G pullup or a 4-G, 60° banked escape maneuver immediately after release.
- Minimum release altitudes with respect to fragment envelope clearance should be observed even if the bomb is released SAFE. This would protect the aircrew in the event of an arming wire hang-up, solenoid malfunction, etc., resulting in an arming wire being extracted and the bomb becoming fully armed.

Note

If the retarded bombs are configured to exclude any cockpit selection of a low drag munition release, a 2.0-second nose fuze arming delay setting may be used if nose fuze arming wire withdrawal is initiated by retarded fin opening action.

WARNING

If high drag ripple releases of the M117R or MK 82 Snakeye I bombs are anticipated using the in-flight high/low drag option selectivity, the munitions must be loaded in the configuration specified in T.O. 1F-4C-1 for this type release.

LEAFLET BOMB DELIVERY

The weapon release computer set can be used to locate the target and automatically release the leaflet bomb. The offset bombing mode, the laydown mode, the dive laydown, or the direct delivery mode can be used for leaflet bombing. The M129E1 leaflet bomb is released from altitudes of 4000 feet through 11, 000 feet. The bombing table states the bomb time of flight and range from release to burst for a given level flight release true airspeed and release altitude above target. The time of flight is used to set the mechanical time delay fuze for a 300-foot detonation. The bomb range is used to estimate the release point. Various wind effects on the bomb prior to burst will be a function of wind velocity and bomb time of flight. The wind effect on the leaflets after detonation and during the descent is difficult, if not impossible, to predict.

FLARE DISPENSING

The SUU-25A/A, B/A, C/A flare dispenser is used to deliver the MK 24 flares. The delivery aircraft approaches the target in level flight at the preplanned release altitude. The MK 24 flare profile and parameters are illustrated in figure 1-42. Release airspeed is not a critical parameter. Release altitude is critical only when it is desirable to have flare burnout above the ground. The flare dispensing table, T.O. 1F-4C-34-1-2 provides the minimum release

altitude AGL for flare burnout at impact. The desired burnout altitude AGL must be added to the minimum release altitude AGL to determine the actual release altitude AGL. The flare dispensing table also provides the horizontal distance traveled and vertical drop of the flare prior to ignition. The flare ejection fuze delay time and the flare ignition fuze delay time is set according to mission requirements and the data on the flare dispensing table. To properly position the flare at ignition, rangewind effect and crosswind offset (ft) may be determined by multiplying the rangewind or crosswind component (kts) times 1.7 times the sum of the ejection and ignition fuze delay settings.

LOFT BOMBING

Note

Also refer to LABS/WRCS Bombing Modes, this section.

The loft bombing mode combines the use of the multiple weapons release system (MWRS) with the attitude reference and bombing computer set (ARBCS). The purpose of the loft bombing mode is to provide a ripple release capability of GP bombs from low altitude with a minimum of aircraft exposure time to groundfire and without a target fly-over. This is accomplished as illustrated in figure 1-41.

During mission planning, an IP (Identification Point) is selected on the target map, or photos, that is located near and on course to the target; the pullup point is established; the release angle of the first and last bomb, the pattern length of the bombs, and the pullup timer setting are also defined.

Prior to the bombing run, the pedestal panel is set for a bombs ripple release with the master arm switch in ARM and the stations selected; the delivery mode selector knob is positioned to LOFT. The LABS bomb release angle computer is set for a low angle (loft) release.

Note

The AC may use the Fast Erect switch to momentarily cage the AN/AJB-7 gyros and correct any gyro precession during the level, constant speed target run-in. Refer to LABS/WRCS Bombing Modes, this section.

When LOFT is selected and the optical sight is operated in the A/G mode, the sight is pitch stabilized with reference to the horizontal platform and can be manually depressed. The sight is not drift stabilized. The reticle light will follow the pullup indications (pullup light ON - reticle light ON, pullup light OFF - reticle light OFF). Either bomb button (front or rear cockpit) is depressed over the IP; this starts the pullup timer countdown. Bomb button power also energizes relays which illuminate the pullup light, and which move the horizontal and vertical pointers of the ADI into view over the center of the sphere. The vertical pointer initially indicates roll flight deviations and the horizontal pointer shows deviations from 1.0 G flight. The appearance of the pointers indicates that the ARBCS has properly switched into the LOFT bombing function. At the end of the total time interval, pullup voltage is applied to the tone generator producing a continuous audible tone. The pullup light circuit is deenergized and the light goes off. These are the direct indications to begin pullup. The AC should select MIL power and begin rotation into the pullup maneuver. As the timer complete contacts close, voltage is applied to one side of the low and high angle release switches which are not yet energized. Relays in the flight director bombing computer are energized to start the G programmer. The ADI horizontal pointer now indicates G error based on 4 G obtained in 2 seconds. The horizontal pointer deflects upward unless the AC begins pullup.

When the aircraft reaches the preset pitch attitude, the release angle switch closes and applies the release signal. As release voltage is applied, the tone generator is deenergized, the timer is reset, and the pullup light illuminates. The AC continues to hold the bomb button depressed and the G program will continue to be displayed by the ADI horizontal pointer as an aid in completing the maneuver. The vertical pointer, however, is deflected out of view at release. When the AC releases the bomb button, all bombing voltage is removed and the horizontal pointer deflects out of view, and the pullup light goes off.

Note

During the LOFT mode, once the bomb button is depressed, it must remain depressed until final bomb release. If the bomb button is released before the first bomb is released, a lockout circuit is energized and the run cannot be continued by depressing the bomb button. To overcome the interlock, the bomb mode selector knob must be positioned out of the LOFT function and then returned to LOFT.

The LADD bombing system can be used to perform the loft bomb delivery. This is accomplished by selecting the LADD mode on the bomb mode selector switch and setting the pullup-to-release time (from the bombing tables) on the Release Timer. The release signals are the same as for the loft bombing

mode. The horizontal needle on the ADI sphere will program 3.5 G in 1.5 seconds (not 4.0 G in 2 seconds as for the loft mode) until approximately 38° pitch attitude is achieved. Therefore, the ADI cannot be used above 38° when the LADD bombing system is used to accomplish the loft delivery, the aircraft accelerometer must be used to establish the pullup acceleration until buffet onset.

AIRCRAFT WEAPON SYSTEM CONTROLS (F-4E) BEFORE T.O. 1F-4E-556

In order to simplify a description of weapons control, the aircrew might consider the aircraft in terms of three weapons categories: nuclear system, air-to-air missile system, and multiple weapons system. The nuclear system references weapons which are selected/armed through the DCU-94/A panel; the air-to-air missile system pertains to those weapons selected through the missile control panel; and the multiple weapons system pertains to weapons controlled through the pedestal panel. These categories are chosen since the electrical system and class of weapon for each are somewhat unique, even though their mission may be identical. For example, the multiple weapons (pedestal panel) system can be energized only if the nuclear system is deenergized. Also, the air-to-air missile launch system can be locked out if certain pedestal panel switches are energized during FCS/missile operations. The following components are those which support the multiple weapons capabilities of the aircraft.

a. Delivery mode selector panel.
b. Station and weapon selection panel.
c. Weapon delivery panel (AJB-7/WRCS integrate).
d. Weapons release computer set (WRCS) AN/ASQ-91.
e. Lead computing optical sight system (LCOSS) AN/ASG-26.
f. Inertial navigation set (INS) AN/ASN-63.
g. AN/APQ-120 radar set.
h. Attitude reference and bombing computer set (ARBCS) AN/AJB-7.

The multiple weapons control system provides the aircraft with the capability of carrying all forms of conventional armament, which include various types of high and low drag GP bombs, fire bombs, chemical bombs, rockets, missiles, guns, smoke grenades, land mines, and leaflet dispensers. The normal weapon select and release arm functions are available through the multiple weapons (pedestal) panel in the forward cockpit (figure 1-43). The control stick bomb button or trigger switch controls the application of weapons fire/launch voltage for all weapons configurations. An aircraft intervalometer dispenses the fire signals so that weapons are deployed at the desired sequence and at the selected release interval. The aircraft emergency stores release circuit and controls provide the jettison capability for individual stations or for all stations simultaneously.

DELIVERY MODE SELECTOR PANEL

The delivery mode selector panel (figure 1-43) is located in the front cockpit on the main instrument panel, placarded LABS on the left, and WPN REL on the right. The selector knob is used to select one of twelve delivery modes. The six LABS delivery modes are placarded DIRECT, TIMED LEVEL, TIMED LADD, TIMED O/S, LOFT, and INST O/S. The DIRECT position is used for bombing rocket or gun firing with a fixed, depressible sight. The LOFT position is used to perform the loft bomb ripple release mode. The OFF position removes power from the WRCS or the LABS bombing modes thereby preventing a release signal from reaching the bomb release relay. The guns can be fired with the mode selector switch in the OFF position or any other position. The six WRCS delivery modes are on the right side of the mode selector knob, placarded WPN REL: TGT FIND (target finding), DIVE TOSS, DIVE LAY (dive laydown), LAYDOWN, OFFSET BOMB, and AGM-45. The nuclear stores jettison button, which may be used for multiple weapons jettison, is in the center of the mode selector knob (refer to Jettison Controls, this section).

STATION AND WEAPON SELECT PANEL

The station and weapon select control panel (pedestal figure 1-43) contains all switches necessary to select and at least pre-arm the specific weapon and weapon fire circuit. The first three controls discussed below must be energized to deploy multiple weapons selectable on the pedestal. The remaining pedestal controls are handled depending on the type of weapon aboard. Also, to deploy pedestal panel weapons, a delivery mode must be selected such as DIRECT, OFFSET BOMB, etc. The only exception to this is the nose gun and gun pod weapons for which the pedestal panel controls are complete for selection and fire. Armament bus voltage is available for aircraft weapon select, weapon release, and fuze arming as soon as the landing gear handle is placed in the UP position.

WEAPON SELECTOR KNOB

The AC positions the weapon selector for the type of weapon aboard the aircraft; either A/G MISSILES, GUNS, BOMBS, or RKTS & DISP. With the knob set for the weapon aboard, voltage is available for station selection and for those armament station relays which must be energized to deploy that weapon. The control also closes circuits which govern the intervalometer release pulse output mode; either SINGLE; TRIPLE, or RIPPLE. These modes apply only to BOMBS or RKTS & DISP weapons as figure 1-43 shows. Each of these selections are discussed in

later paragraphs. To unlock the multiple weapon system further, the AC selects the required armament station through the station select controls.

Note

When the weapon select knob is in the AGM-15 position, IR missile status and the audio tone is not available until the missile arm switch is in ARM.

STATION SELECTOR BUTTONS

The six station selector buttons are placarded LO (left outboard), LI (left inboard), CTR (center), RI (right inboard), and RO (right outboard), and NOSE. (The NOSE station selector applies only to the nose gun system.) Depressing the button(s) closes the corresponding station select relays, which in turn closes a portion of the weapon fire circuit. At this point, the green (upper) light in the button housing illuminates, which is an indication only that the button has been depressed. The amber light illuminates after the master arm circuits are energized. A rheostat knob (figure 1-43) is added to the pedestal to control the intensity of the station select green and amber lights.

CAUTION

The station select buttons (inboard) immediately energize the SUU-23 gun pod prestart circuits and start the gun inertial motor. To avoid inertial motor burn-out avoid selecting the stations during ground operations or any operations not directly involving the gun pod.

MASTER ARM SWITCH

The master arm switch has two positions, SAFE and ARM. In ARM, power is supplied to the bomb button transfer relay and the arm nose tail switch. Application of power energizes the bomb button transfer relay and the function of the bomb button is transferred from the nuclear weapons system to the nonnuclear weapons system. (Refer to bomb button transfer relay, this section.) The switch must be in the ARM position to deliver all nonnuclear weapons, excluding air-to-air missiles.

When master arm energized, the amber light illuminates on the activated station select button. The amber light indications can be summarized as follows:

1. The trigger switch and bomb button controls are activated into the multiple weapons fire, release, or launch circuits.
2. The aircraft is electrically configured for the weapon selected. (The pylon-to-aircraft and pylon-to-store adapter bundles are properly installed.) In the case of MER/TER equipment, the stepper switch in these units must be properly homed.
3. For certain weapons, the light indicates that the weapon selected is aboard.

Conditions 1 and 2 are applicable to all multiple weapons configurations. Condition 3 applies only to gun pods, the AGM-45 missile, the the Mark 1 Mod 0 glide bomb. These are single-carriage items only. (With the Mark 1 Mod 0 aboard, the radar must be operated in the applicable mode to get the amber light.) Hence, the three controls must be positioned to deploy any multiple weapons configuration. In the case of gun weapons, the AC depresses the forward trigger switch to fire. For all other pedestal weapons, a delivery mode (DIRECT, TGT FIND, etc.) must be selected to complete the launch/release circuit. The following controls are positioned only if a specific weapon is aboard.

ARM NOSE TAIL SWITCH

This switch (figure 1-43, sheet 1) completes the circuit between the master arm switch and the arming solenoids in the aircraft ejector racks (MAU-12, BRU-5/A, and MER/TER). The energized solenoids retain the arming wire swivel loops and as munitions are ejected, the arming wires are pulled to initiate the fuze arming sequence. In the SAFE position, the arming wires are retained by the munition during separation from the aircraft and the associated fuze remains SAFE.

The arm nose tail switch also provides the selective high/low drag capability for those weapons which may be rigged for either a freefall or retarded drop. In this case, the solenoids are energized to apply the holding force for the lanyards which deploy the retardation device. (Refer to M117R and MK 82 Snakeye I bombs, and Arming Wire Routing, part 4.)

WARNING

If this switch is used to select the M117R or MK 82 (Snakeye I) high/low drag release option in flight, the warnings and notes listed in Mission Description, High Drag GP Bomb Delivery, must be carefully observed.

The switch positions and corresponding solenoids armed are shown below.

Switch Position	Solenoid Armed
SAFE	None
NOSE	Fwd and Ctr
TAIL	Aft
NOSE & TAIL	Fwd, Ctr, and Aft

There is no center solenoid on the MER/TER and BRU-5/A ejector racks

With MER/TER equipment that do not have automatic homing, the arm nose tail switch must be in the NOSE or NOSE & TAIL position to apply power through the sensing switch to the MER/TER stepper solenoid. Then with a partial load of bombs aboard, the empty stations are bypassed and the pilot releases one bomb with each pickle signal. The TAIL position does not apply the stepping voltage and an extra pickle must be delivered to step through each empty MER/TER station.

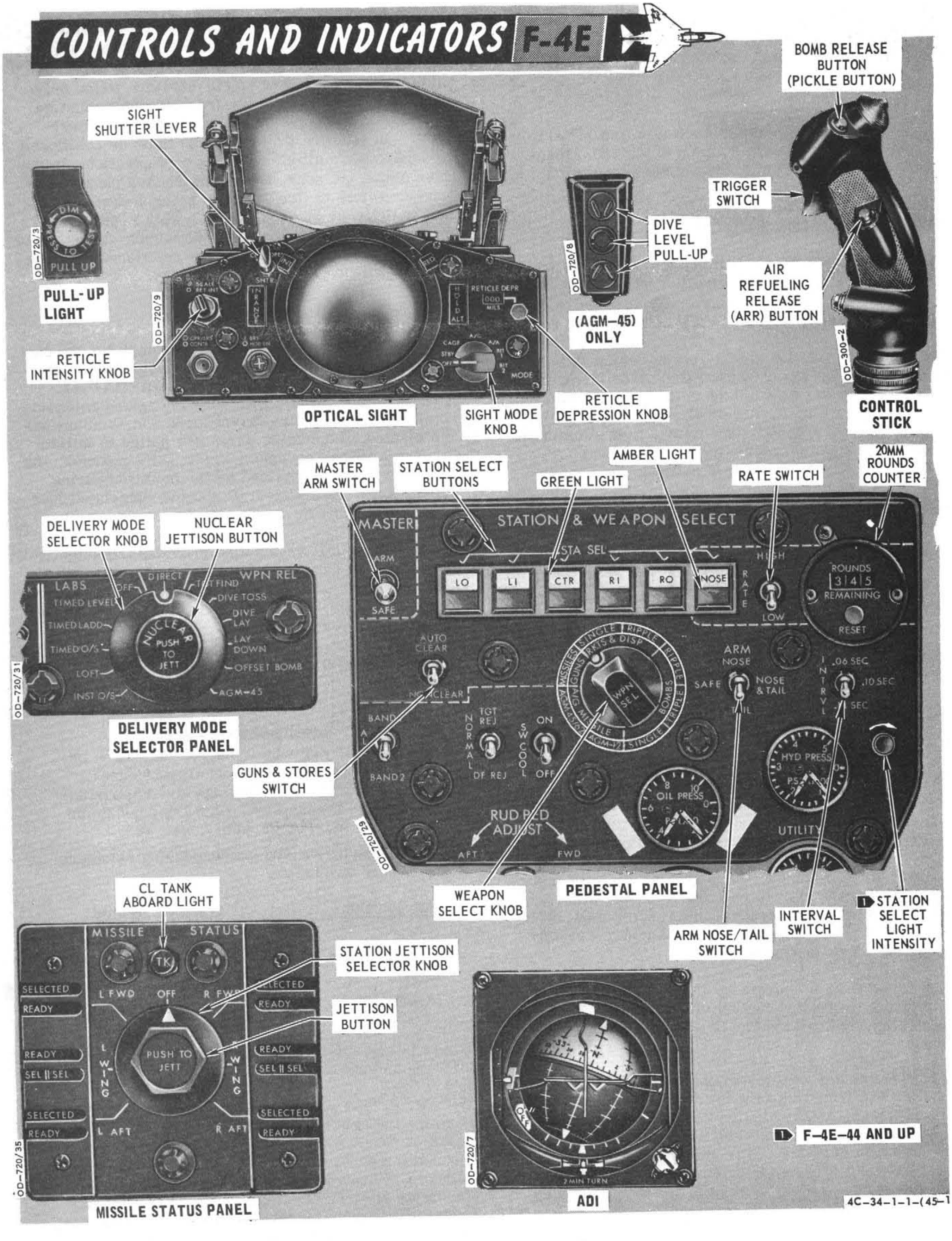


Figure 1-43 (Sheet 1 of 2)

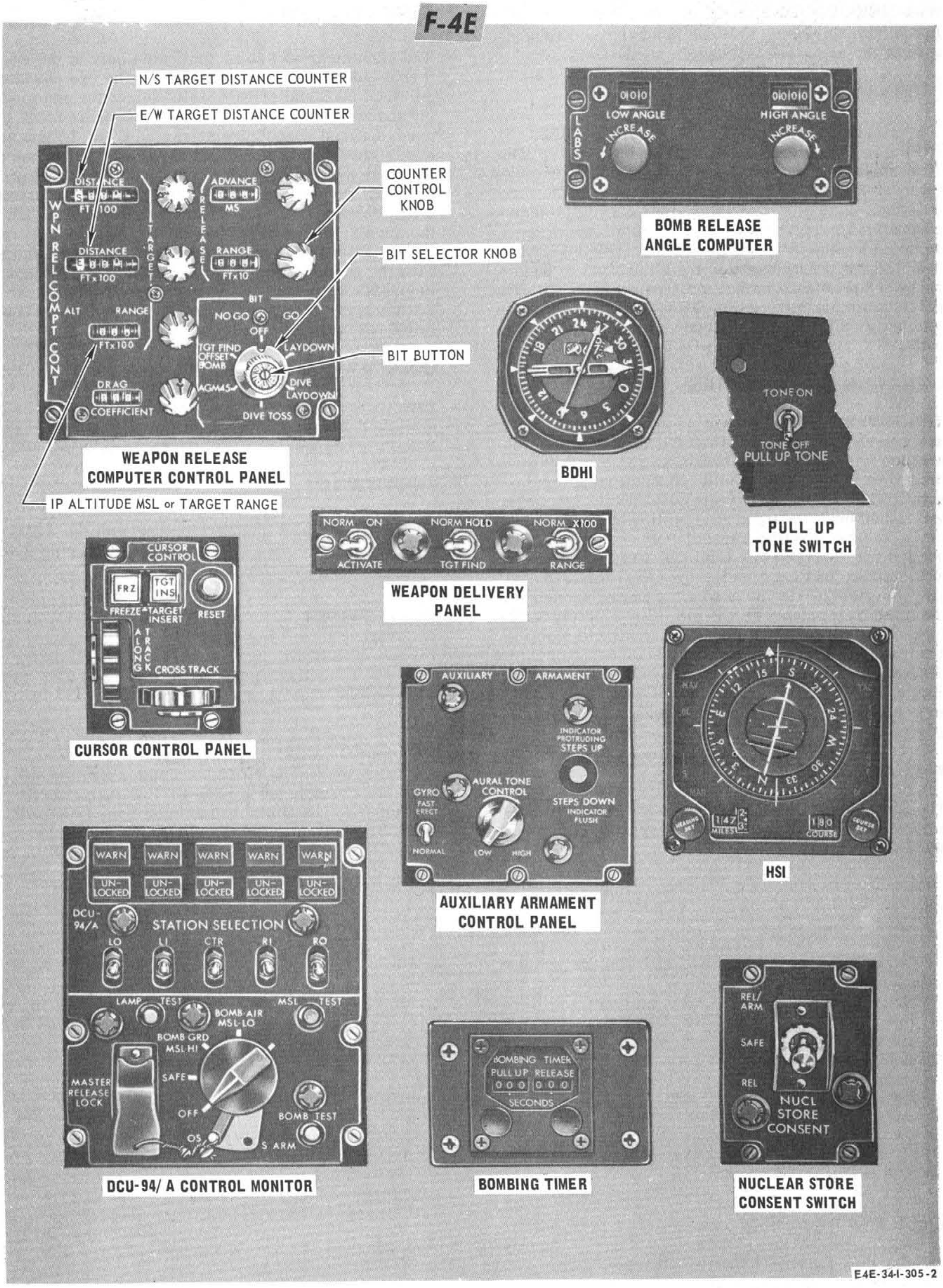


Figure 1-43 (Sheet 2 of 2)

With MER-10A and TER-9A equipment that have automatic homing, empty stations are bypassed regardless of the arm nose tail switch position.

INTERVAL SWITCH

The interval switch is used only during BOMBS/RIPPLE, BOMBS/TRIPLE, and RKTS & DISP/RIPPLE modes on the weapon selector knob, to establish interval between each release. The switch has three positions (0.06 SEC, 0.10 SEC, and 0.14 SEC) that determine the pulse interval: the pulse length or duration is always the same (23 to 33 milliseconds). The pulse rate is measured from the start of each pulse and therefore includes the pulse duration. The pulse rate tolerance of the various release intervals are: 60 to 90, 100 to 115, and 140 to 161 milliseconds.

GUNS AND STORES SWITCH

This control, applicable only to gun armament, energizes the same circuits as the GUNS position on the weapon selector. By using this switch to select guns, the AC is free to select other pedestal panel armament (BOMBS, etc.) by positioning the weapon selector. Then with the applicable stations selected and the master arm switch closed, both the trigger and bomb button are activated into the fire/release circuit. Either method of selecting guns will ready all guns for firing; this includes any gun pod aboard and the internally mounted nose gun. One electrical difference exists between the two methods of selecting guns; the GUNS position of the weapon selector limits the optical sight operating modes to those which are applicable only to guns. If the GUNS and STORES switch is used, the sight operating functions are governed by the delivery mode selector knob.

RATE SWITCH

The rate switch and the rounds counter immediately adjacent are functional only in the nose gun weapon system. Refer to Nose Gun System, this section.

GUNS CLEAR SWITCH

The guns clear switch is applicable only in the external gun pod operating circuits. The two positions, AUTOCLEAR and NONCLEAR, select the gun clearing mode of operation. When the autoclear mode is used, unfired rounds are extracted from the gun and ejected overboard at the end of each burst. When the nonclear mode is used, the unfired rounds remain in the gun. Hence, the NONCLEAR position is selected when the gun pod is to be fired in short burst. When the guns are fired in the nonclear mode and several rounds remain unfired, a final burst must be fired with the switch positioned to AUTOCLEAR to clear the guns. If the gun is fired out with the gun clear switch in the NONCLEAR position, the bolt assemblies automatically clear.

REJECT SWITCH

The reject switch is applicable to the AGM-45 missile DF control circuits. Refer to the AGM-45 missile system in T.O. 1F-4C-34-1-1A.

BAND SWITCH

The band switch is intended for use with the AGM-45 missile system. The switch, however, has no function at the present time.

FILTER SWITCH

The filter switch is functional in the filter control network of the Mark 1 Mod 0 weapon. See T.O. 1F-4C-34-1-1A.

Note

If the aircraft is configured with a SUU-42A/A jumper bundle (53-09790-107) at the outboard stations, the filter switch must be maintained in the RED position to get release and transfer voltage to the inboard and CL stations.

TRIGGER SWITCH

The front cockpit trigger switch on the control stick, is functional only in the air-to-air missile and gun firing circuits, and in the Mark 1 Mod 0 lockon circuit. When the spring-loaded switch is actuated, power is supplied to initiate gun rotation and start the ammunition feed system. The gun starts firing when the trigger switch is depressed and ceases firing when the trigger is released. Power can be removed from the trigger switch by pulling the gun trig circuit breaker, No. 1 panel. The trigger switch in the rear cockpit is always inoperative as far as weapon deployment is concerned, but will supply the Mark 1 Mod 0 lockon signal. For missile launching, refer to T.O. 1F-4C-34-1-1A.

WARNING

The trigger switch requires very little movement to initiate gun firing; therefore, the AC should clutch the trigger only when the gun is to be fired.

With the addition of the optical sight camera (T.O. 1F-4E-558), the trigger becomes a double detent switch referenced here as trigger 1 and trigger 2. The trigger 1 position operates the camera without munition expenditure; trigger 2 fires the selected munition and operates the camera. Refer to Optical Sight Camera, this part.

TRIGGER TRANSFER RELAY

The trigger transfer relay must be energized to fire guns and must be deenergized to launch air-to-air missiles. To fire guns, the trigger transfer relay is energized by selecting guns and energizing the bomb button transfer relay as follows:

a. The bomb button transfer relay can be energized by positioning the master arm switch to ARM, and the DCU-94/A master release lock switch AFT.

b. Guns can be selected by positioning the weapon selector knob to GUNS, or by positioning the guns and stores switch to GUNS & STORES, and by selecting the NOSE GUN station.

Note

- When the trigger transfer relay is energized, all missile status lights on the missile status panel will go out. The TK light remains on if the tank aboard relay is energized. The tuned status of the missiles will not be affected.
- The nose gear up limit switch must be energized to fire the centerline gun pod. The nose gun and the outboard guns can be fired regardless of the nose gear up limit switch position.

To launch air-to-air missiles, the trigger transfer relay must be deenergized. If guns are selected, the trigger transfer relay is deenergized by positioning the master arm switch to SAFE.

BOMB BUTTON

The bomb or pickle button (figure 1-43) is on the upper left side of each control stick grip in the forward and rear cockpit. The button is spring-loaded to OFF. Depressing the bomb button (in either cockpit) will fire/release all air-to-ground weapons selected on the multiple weapons control panel (except guns), or on the DCU-94/A monitor-control panel. Power can be removed from the bomb release button by pulling the A/G weapon release cont circuit breaker, No. 1 panel.

BOMB BUTTON TRANSFER RELAY

The bomb button transfer relay must be energized to pull the bomb button into the multiple weapons release circuits. The relay is energized when the master arm switch is positioned to ARM, providing one of the following switches is positioned AFT or SAFE:

a. DCU-94/A all station selector switches - AFT
b. DCU-94/A master release lock switch - AFT
c. Nuclear store consent switch - SAFE

If one of the station selector switches, the master release lock switch, and the nuclear store consent switch are energized, the bomb button transfer relay deenergizes (nuclear release) regardless of the master arm switch position.

PULLUP LIGHT

The pullup light on the front cockpit instrument panel is a press-to-test type light. The lamp intensity can be controlled by rotating the outer ring to vary the size of the iris over the lamp. The pullup light illuminates during all release modes when the bomb button signal is generated, and goes out when the bomb button is released.

PULLUP TONE

An audio tone is present in the headset for specific AN/AJB-7 and WRCS automatic modes (except AGM-45). With the bomb button depressed, the tone functions until a bomb release signal is generated. The tone is generated by the AN/AJB-7 audio tone generator and the volume level is controlled by the aural tone control on the left console.

Pullup Tone Cut-Off Switch

The pullup tone cut-off switch is on the left console, rear cockpit. The switch enables the aircrew to preclude external transmission of the audio tone during any bombing mode in which the tone signal is involved. With the switch in TONE ON, the audio tone signal is transmitted through the UHF transmitter. The TONE OFF position deenergizes the same tone transmit circuit. In either case, the aircrew hears the tone and all tone functions remain the same.

WEAPON RELEASE/LAUNCH MODES

The following generally describes the methods by which the aircrew may deploy bomb and rocket or dispenser armament. (AGM weapons and gun systems are described later in this section.) It is assumed that the AC has selected the weapon, selected the applicable station(s) energized master arm, and selected the DIRECT delivery mode. The following release options are those which correspond to the selectable positions on the pedestal weapon selector (figure 1-43).

BOMBS/SINGLE

When the weapon selector knob is positioned to BOMBS/SINGLE, one bomb is released from each station selected when the bomb button is depressed (figure 1-44). If five stations are selected and loaded, five bombs are released simultaneously. This applies to either single or MER/TER bomb carriage configurations. In the case of singles carriage, the station amber light goes out as each weapon leaves the pylon. Considering multiple carriage, the amber light goes off as each MER/TER carrier becomes completely empty.

BOMBS/TRIPLE

With BOMBS/TRIPLE selected and the bomb button held depressed, three bombs are ripple released (figure 1-44). The time interval between bombs is established by the position of the interval switch; 0.06 sec, 0.10 sec, or 0.14 sec. The bomb release button must be held depressed until the three bombs are released. With only one station selected, three bombs are released from that station (assuming MER/TER carriage). When a left and a right station is selected, the release pulse is directed alternately between the left and right station, releasing two bombs from one side and one bomb from the other. There is no provision for determining which side receives the first release signal. With all stations selected, bombs will triple-release with each bomb button signal until the entire weapon load is expended. The station amber light functions as described above.

BOMBS/RIPPLE

With BOMBS/RIPPLE selected and the bomb button held depressed, the selected bombs are released singularly with the time interval between bombs established by the position of the interval switch (figure 1-44). Bombs continue to be released until the bomb button is released, or until the selected station load is depleted. When five stations are selected, all bombs from the outboard stations are released, then the inboard stations, and finally the centerline station. The release pulse is directed alternately from left to right wing stations. There is no provision for determining which side (left or right wing station) receives the first release pulse; normally the left side receives the first release pulse. (If the pilot selects both stations on one wing, i.e., LO and LI, then weapons release alternately from each of the stations.) The station amber light goes off as each pylon station becomes empty (singles), or as each MER/TER becomes completely empty.

ROCKETS AND DISPENSER/SINGLE

Selecting RKTS & DISP and depressing the bomb button will fire-out one rocket pod, or fire out one shot consisting of a predetermined number of tubes from one CBU dispenser. If five stations are selected, five rocket launchers or CBU's will fire simultaneously with the application of each bomb button signal. Only the DIRECT delivery mode can be used to fire rocket launchers or CBU dispensers. In the case of CBU's, the station amber light flashes when any CBU on that station has two shots remaining (which may consist of several tubes). The light goes out when all CBU's are empty. With rocket pods aboard, the amber light will not provide the expended indication; the light remains on when the pods are empty. With either armament aboard, the AC can select BOMBS and release the empty pods/dispensers and observe the station amber light go off as a release indicator.

Note

TER 9A and MER 10A equipment does not have the CBU flasher circuit as stated above.

ROCKETS AND DISPENSER/RIPPLE

Note

The single firing pulse in the ripple mode is not of sufficient duration to completely fire-out the entire rocket launcher. The remaining rockets will fire, however, as the pulse steps back through the partially expended launchers.

With RKTS & DISP/RIPPLE selected and the bomb button held depressed, the CBU dispenser (or rocket launcher) will fire singularly at a time interval between each dispenser established by the position of the interval switch, either 0.06 sec, 0.10 sec, or 0.14 sec. Ripple firing pulses continue until the bomb button is released or until the selected aircraft station fires out completely. The firing pulses are directed alternately (and symmetrically) between the left and right wing stations. When five stations are selected, only the outboard station armament is initially fired out. The firing pulses will not transfer to the inboard stations until the outboard stations are de-selected; nor will the firing pulse reach the centerline station until both the outboard and the inboard station selector buttons are pushed OFF. There is no provision for determining which station (left or right) receives the first firing pulse. The station amber light functions previously stated apply here.

GUNS

The gun pods (SUU-16/A or SUU-23/A) and the M61A1 nose gun are selected for firing as stated previously. The AC selects GUNS, depresses the appropriate station selector(s), and energizes master arm. The corresponding station amber light illuminates and the trigger circuit is hot. These gun systems are described later in this section.

A/G MISSILES

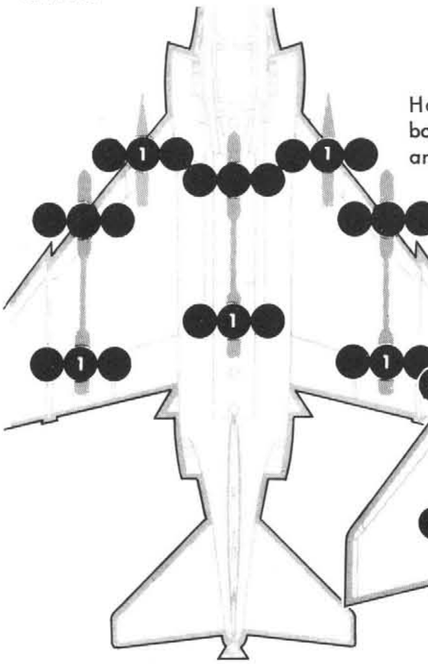
The AGM-45, AGM-12B and C, and the Mark 1 Mod 0 air-to-ground weapon are each initially selected as stated previously. The weapon is selected, the applicable station(s) are selected, and the master arm circuits are energized. Additional controls which are unique in these missile control circuits are discussed later in this section.

NORMAL RELEASE SEQUENCE F-4E

5 STATIONS LOADED, 5 STATIONS SELECTED

SINGLE

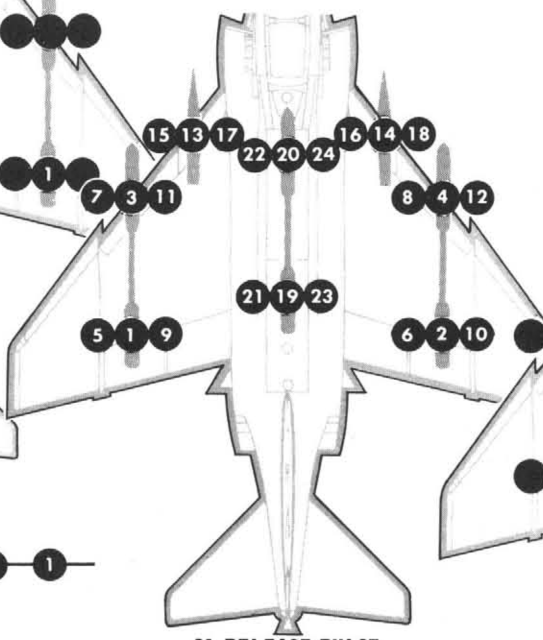
Each bomb button signal simultaneously releases one bomb from each selected station.



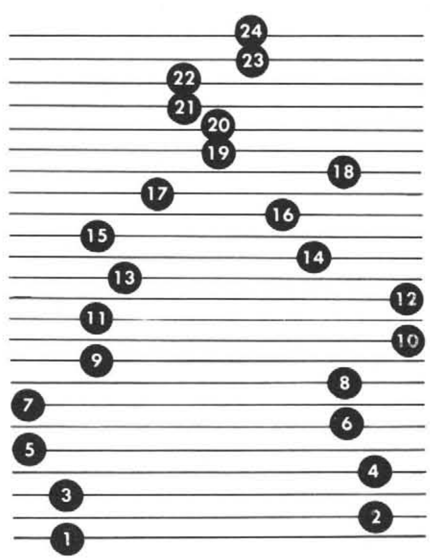
1 RELEASE PULSE

RIPPLE

Holding the bomb button depressed releases bombs continuously in the left-right order and at the selected bomb release interval.



24 RELEASE PULSE

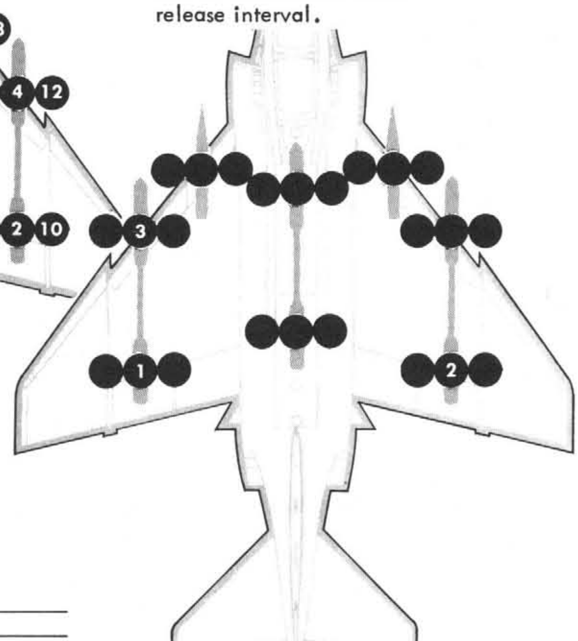


Note

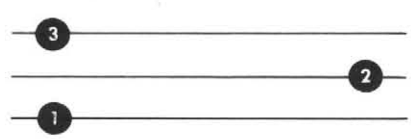
When two or more stations are selected, there is no indication which station receives the first release pulse, left or right. Normally, the left station receives the first release pulse.

TRIPLE

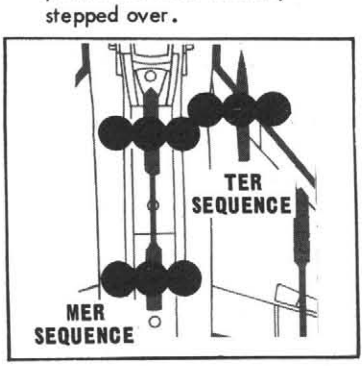
Holding the bomb button depressed releases three bombs in the ripple release sequence and at the selected bomb release interval.



3 RELEASE PULSES



The MER and TER release sequence always remains as illustrated here. Empty points are automatically stepped over.



4C-34-1-1-(46)

Figure 1-44

AIRCRAFT WEAPON SYSTEM CONTROLS (F-4E) AFTER T.O. 1F-4E-556

This description contains information pertaining to the installation of an improved conventional weapons control system in all F-4E aircraft. The major changes and improvements may be generally defined as follows:

a. The forward cockpit weapons control panels are relocated so that all weapons functions and indications are controlled and observed in one common area.
b. The weapons select functions and switching logic is designed so that the AC may switch from any weapons mission status into a close-in, air-to-air environment with rapid, finger-tip control action.
c. External store jettison functions are simplified and occur through controls on the weapons panels. In fact, anything to do with selective conventional stores separation occurs through these same panels. Fuel tank and ECM jettison controls previously located on the forward cockpit left console are deleted. The missile jettison capability is removed from the external stores emergency release button.

The major control panel changes and additions occur in the front cockpit as shown in figure 1-44A; the rear cockpit modification is shown in figure 1-44B. Items that are added to the front cockpit are the throttle weapons controls, the Aircraft Weapons Release Unit (AWRU), and the head-up weapon select and arm display lights mounted on the left under the glare shield.

All air-to-air and air-to-ground weapons are armed, released, and jettisoned through these controls. There is essentially no interlock between trigger-fired and bomb button-released weapons. In other words, air-to-air weapons fired through the trigger, and bomb/dispenser munitions released by the bomb button may be armed for launch simultaneously. If the aircraft is loaded with both air-to-air and air-to-ground weapons that are launched through the trigger, a rapid method exists for switching the trigger circuit to accomodate either of the two. With the launch circuits so arranged, aircrews on air-to-ground missions can instantly meet air-to-air commitments. The aircraft weapon release systems (WRCS, AJB-7, etc) are not changed.

AIR-TO-GROUND WEAPONS

DELIVERY MODE SELECTOR

The functions of this control remain unchanged. One of the delivery modes must be selected in order to release any air-to-ground weapon available on the weapon selector (WPN SEL) knob. The DIRECT mode applies an immediate release signal. The remaining selections are the (T) timed, AN-AJB-7, and WRCS automatic release systems. The OFF and TGT FIND positions of this control are essentially the SAFE positions for the munitions available on the WPN SEL knob. This is true since the master arm switch is a common ARM/SAFE switch for all conventional weapons and must be ARMED for heat and radar missiles.

WEAPON SELECTOR KNOB

The AC positions the weapon selector for the type of munition aboard. The control essentially provides the same electrical functions as the previous control, but the selective positions are changed. The BOMBS and RKTS & DISP positions select those munitions respectively and apply operate power to the Aircraft Weapons Release Unit (AWRU). These are the only WPN SEL positions that operate the AWRU. The ARM position selects Anti-Radiation Missiles and is applicable to the AGM-45 missile or any other munition of this type which may become available. The TV position is selected for the TV guided weapons or any EO weapon requiring a video display. The AGM-12 position is described in a separate part of this manual.

Note

- The AGM-12 control handle (left console) is not installed in some aircraft, and therefore removes the weapon capability. Although aircraft (71-237) and up contain the control handle for AGM-65 (Maverick) missile operations, the AGM-12 capability is not available in these aircraft.
- The ARM and TV positions control the trigger circuits so that guns, radar and heat missiles cannot be fired unless the CAGE signal is present. (Refer to the CAGE description in later paragraphs.)

The remaining selections on this control are A, B, and C. The C position is an open position and has no current use. The B position provides the same switching function as the AIR-TO-AIR button in the rear cockpit. The B selection reverses (uncages) the cage signal applied to weapon system components through the CAGE button on the throttle. The cage and uncage functions are described in later paragraphs.

Note

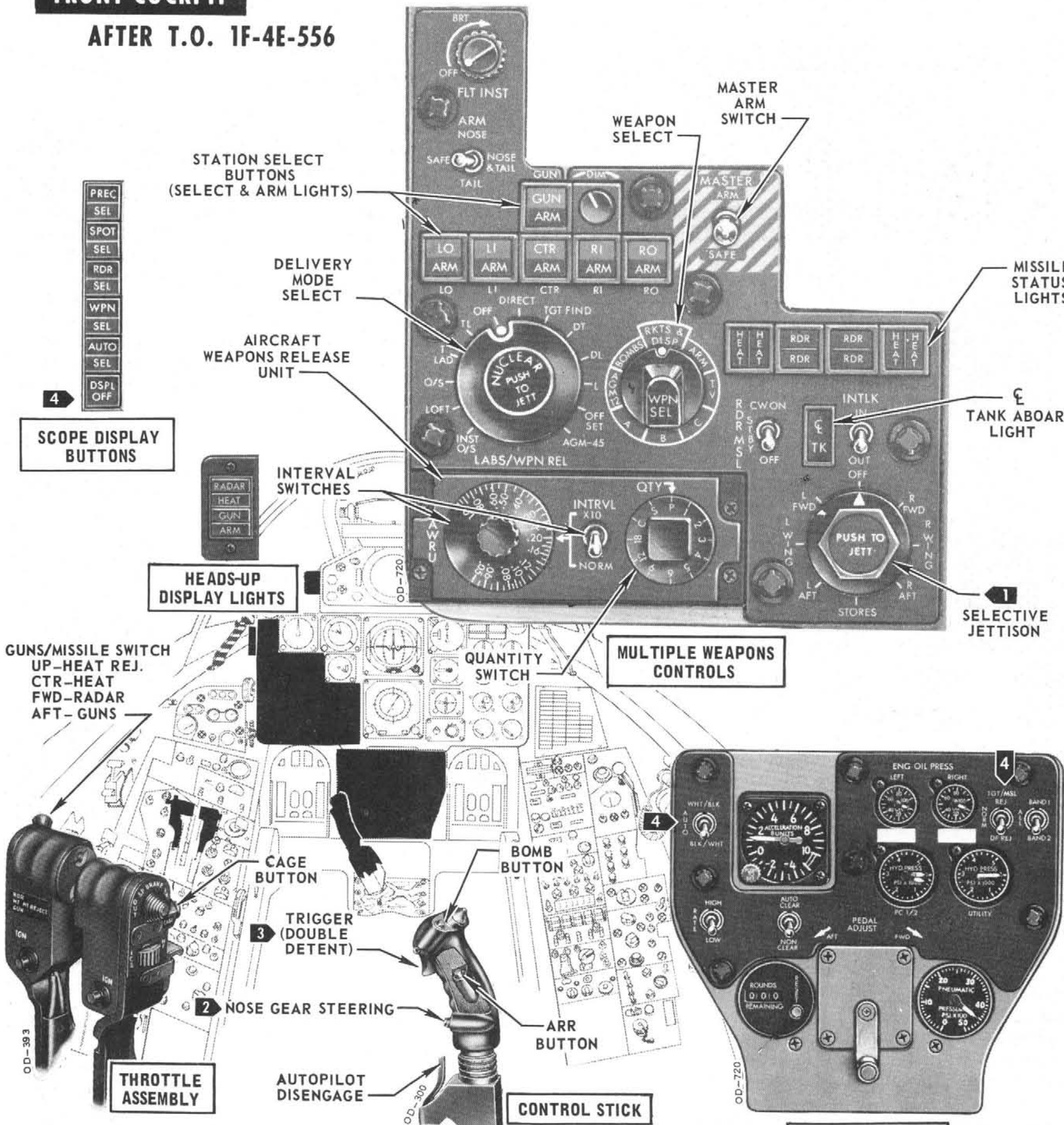
The B position, and currently the C position are OFF/SAFE selections on the WPN SEL control.

The WPN SEL A position applies continuous (non-pulse) voltage to the selected station(s) as long as the bomb button is depressed. The position may be used for munitions which contain their own intervalometers such as CBUs, rocket packages, or multiple spray containers that are dispensed simultaneously. With A selected, only these munitions can be launched from MER/TER equipment; bomb munitions will not release. With the bomb button signal applied, one dispenser fires completely from each selected station. The bomb button is released

CONTROLS and INDICATORS F-4E

FRONT COCKPIT

AFTER T.O. 1F-4E-556



1. THE CENTER STA. WING STA., AND ECM JETTISON SWITCHES ON LEFT CONSOLE ARE REMOVED BY T.O. 1F-4E-556.
2. AUTO ACQUISITION FUNCTION ADDED. HEADING HOLD FUNCTION REMOVED.
3. AFTER T.O. 1F-4E-558.
4. F-4E (71-237) AND UP.

4C-34-1-1-(211)

Figure 1-44A

CONTROLS & INDICATORS

F-4E

REAR COCKPIT

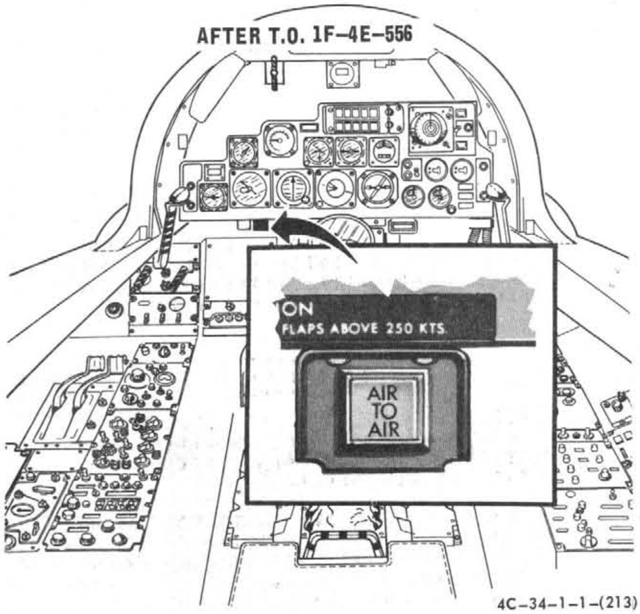


Figure 1-44B

and depressed again to fire the next set of dispensers. This is essentially a manual-salvo firing sequence since the mode is comparable to the SALVO mode shown in figure 1-44C. The A method is non-automatic since the AWRU is bypassed; the MER/TER stepping sequence is accomplished by releasing the bomb button.

STATION SELECT BUTTONS

The station select buttons (figure 1-44B) must be depressed to select and fire any air-to-ground conventional weapon, including gun pods and the nose gun. The station select green lights illuminate as soon as the buttons are depressed. The amber ARM lights are fire-ready lights and illuminate to indicate a fire-ready bomb button or trigger circuit. A rheostat knob is provided next to the GUN station button to control the station lights intensity. The station select buttons also provide the selective jettison function for the four wing stations and the CL station (stations 1, 2, 5, 8 and 9). With the exception of heat missiles, the required station button(s) must be depressed to jettison any munition (or fuel tank) plus suspension equipment from the corresponding aircraft station. (Refer to Jettison Controls, this part.)

In order to obtain the fire-ready (station ARM light on) indication, the following control conditions must exist.

a. The delivery mode switch is not in the OFF or TGT FIND position (nose gun station excluded).

b. The weapon is selected (on WPN SEL knob, or guns on guns/missile switch) and the weapon aboard is essentially compatible with the weapon selected. For the nose gun, rounds are available and the rounds limiter is not activated.

c. The station(s) are selected.

d. With the WPN SEL in BOMBS, the arm nose tail switch must be in one of the armed positions to get the station ARM light, and therefore get an armed bomb release. (See Arm Nose Tail Switch.)

e. Master arm is in ARM.

MASTER ARM SWITCH

The master arm switch is a lock-toggle switch with the lock detent in the SAFE position. In these aircraft, the switch performs a true MASTER ARM function for all conventional weapons. The ARM position must be selected to fire guns, heat and radar missiles, and launch munitions selected through the WPN SEL knob. Hence, the air-to-air weapons can be armed for launch simultaneously with the air-to-ground munitions, provided the two are not launched through the same (trigger) control. With ARM selected, the ARM light on the heads-up display illuminates (amber). The ARM light illuminates any time the master arm switch is energized, no other control activity is necessary. The ARM light therefore, is not a fire ready indicator; it simply announces the position of the master arm switch. If the remaining weapons controls are also energized, then the station ARM lights together with the heads-up ARM light, provide the fire ready indication.

Note

With bombs selected, the station ARM (amber) light will not illuminate unless the arm nose tail switch is in one of the armed (ON) positions.

For air-to-air missiles and the nose gun, the fire-ready indication is provided by the illumination of both the heads-up ARM, and any one of the GUN, HEAT, or RADAR lights for those munitions respectively. For the nose gun, the station (amber) ARM light is also on.

Note

With master ARM energized and with heat selected on the guns/missile switch, AIM-4D cool-start is initiated immediately.

ARM NOSE TAIL SWITCH

This control provides all of the same functions as described previously. The important difference is that the switch closes a fuze select-ready relay in the BOMBS/station ARM light circuit. With the weapon selector in BOMBS, the station ARM light will not illuminate unless the arm nose tail switch is energized. Conversely, the SAFE position of the switch does not inhibit the BOMBS release circuit. Bombs will release (SAFE) if all other release controls are energized and with only the station green light(s) on. Therefore, the AC will notice that with

BOMBS selected and station green light(s) on, an ARM-light-off indication does not *necessarily* mean that the bomb button circuit is in a SAFE condition.

If the BOMBS position is used to bomb-off rocket or CBU dispensers in a jettison situation, then the arm nose tail switch should be in one of the (ON) positions to get the proper station ARM light indications (MER/TER stations empty).

AIRCRAFT WEAPONS RELEASE UNIT (AWRU)

The AWRU is added to the forward cockpit as shown in figure 1-44A. The unit receives operate power only by the selection of BOMBS or RKTS and DISP modes on the weapon selector. The control panel contains two INTERVL controls, and a quantity (QTY) selector. The interval controls provide the time interval (in seconds) between each weapon release, and therefore determines bomb spread and pattern length. The rotary control provides selectable intervals between 0.05 to 1.0 second, provided the INTRVL rate switch is in the NORM position. With the X10 factor selected, the intervals range from 0.5 to 10 seconds.

The AWRU operates in either one of two modes; manual or automatic. In manual, the unit develops its output coincident with each pickle signal, and the pickle signal must be interrupted and reapplied to get each subsequent output. In automatic, the unit develops pulsed outputs and the bomb button must be held depressed to continue the pulse train. The INTERVL setting applies only to the automatic mode and is simply the time duration between the start of a pulse, and the start of the next pulse. The length of time the pulse is ON is 62.5% of the selected NORM interval, and 60% of a X10 interval.

The QTY control selects the singles, pairs, and salvo release sequences, and can be set to yield an exact number of output pulses. The QTY control selections and the sequences obtained may be defined by the following. (Refer to figure 1-44C.)

AWRU OPERATION WITH MER/TER

Single-Manual

The QTY position 1 selects a single, AWRU manual release sequence. One weapon is released each time the bomb button is depressed. With multiple stations selected, release occurs in alternate left-right order with the first release signal delivered to the left selected station. The release signal is continuous until the bomb button is released.

Single-Ripple

The single-ripple sequence is obtained by selecting any one of the QTY numerical positions 2 thru 18. With the release signal held, the total weapons released is equal to the QTY setting; then the release signal is automatically interrupted. The interval between each release pulse is governed by the INTRVL controls. At the completion of the set number of releases, the bomb button may be released and redepressed to initiate the sequence again. With multiple stations selected, release is in left-right order. The release signal for the last weapon is retained until the bomb button is released.

Single-Continuous

This mode is the same as single-ripple, except the quantity of weapons released is not automatically limited by the AWRU. With QTY position C selected and the pickle signal held-in, weapons release in left-right order until the stations empty or the pickle signal is terminated. The time between each weapon is governed by the INTERVL controls.

Pairs-Manual

The QTY position P is selected to get the pairs mode. One set of simultaneous left and right release pulses is generated each time the bomb button signal is applied. Therefore, with any two (or more) stations selected, two weapons are deployed simultaneously with each pickle signal. With one station selected, the system is essentially in a single-manual mode.

Salvo

The salvo mode is obtained by selecting S on the QTY knob. With the bomb button signal held, continuous release pulses are applied to each selected station; the interval between each release pulse is set by the INTRVL controls. Hence, with five stations selected, five weapons salvo followed by another five at the set interval. With two stations selected, the system is essentially in a pairs-ripple mode.

AWRU OPERATION WITH MAU-12 (SINGLE CARRIAGE)

When weapons are single-carried on the MAU-12 armament pylons, the aircrew can encounter a situation that would result in a release of more weapons than anticipated.

WARNING

For MAU-12 single carriage, the AWRU release interval and quantity selector should be considered unreliable when more than one station is selected.

To explain the preceding statements, consider the following station transfer differences in aircraft with MER/TER stores aboard, and aircraft with single stores aboard. (Assume that at least two aircraft stations are selected.)

a. With MER/TER carriers, QTY 1 selected: The firing function is transfered to the next station only after termination of the first release pulse by releasing the bomb button.

b. With single carriage, QTY 1 selected: The firing function is transferred to the next station when the bomb-gone switch on the MAU-12 rack extends. This may occur before the bomb button signal is released.

When considering item (b), if more than one station is selected, the release function transfers from the first station to a second station by merely releasing the first store. With the bomb button held during transfer, the weapon on the second station releases, even though QTY 1 is selected. The weapons would release at a rate equal to how fast the bomb-gone switch activates. With P (pairs) selected, the same considerations apply except that four weapons would release instead of two (assuming four stations are loaded and selected). Finally, if a ripple mode is selected (QTY 2 or more or C) the release interval between bombs cannot be accurately acquired.

The situation can be avoided entirely for the QTY 1 or P (pairs) mode by selecting only that station (or those stations) to be released.

AIR-TO-AIR WEAPONS

The reference air-to-air weapons in this discussion implies weapons which have select-ready indicators on the heads-up display (figure 1-44A). These munitions are selected by the guns/missile switch on the left throttle. (Gun pods are also selected by this control, but the gun pod select-ready indication is received on the corresponding station select buttons.) The guns/missile switch is actually a weapon select control used to enable the nose gun and the heat and radar missile launch systems. Since the master arm switch performs the ARM function for both the guns/missile switch and the WPN SEL control, then the trigger switch and bomb button circuits can be activated for weapons deployment simultaneously. This was stated previously, but the point to be made is that air-to-air munitions can be maintained es-esentially in a launch-ready state during any other type of mission, including air-to-ground operations. The following description demonstrates the switching function.

NORMAL RELEASE SEQUENCE F-4E

5 STATIONS LOADED, 5 STATIONS SELECTED, BOMBS OR RKTS DISP. MUNITIONS

AFTER T.O. 1F-4E-556

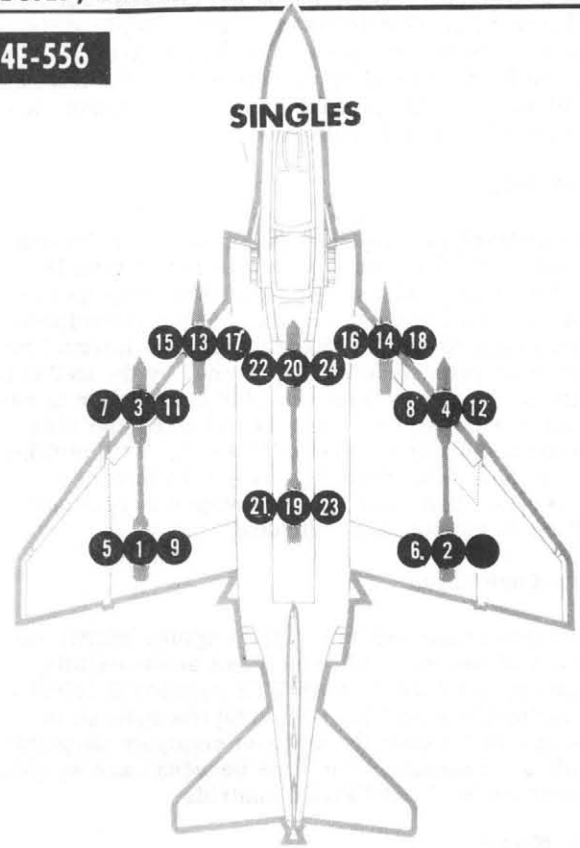
SINGLE-MANUAL (QTY POSITION 1)
ONE WEAPON IS RELEASED WITH EACH BOMB BUTTON SIGNAL IN ALTERNATE (LEFT/RIGHT) ORDER.

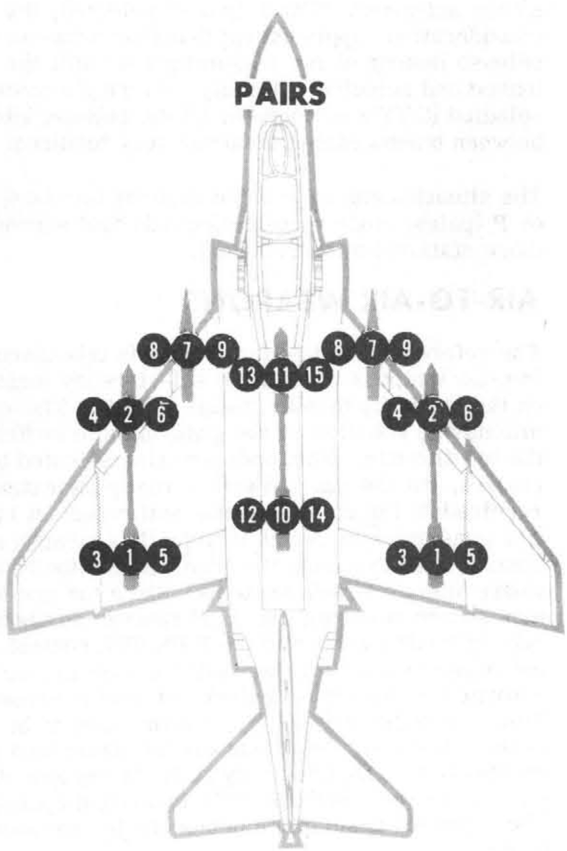
SINGLE-RIPPLE (QTY POSITION 2 THRU 18)
WITH BOMB BUTTON SIGNAL HELD, WEAPONS RELEASE ALTERNATELY AT THE SELECTED RELEASE **INTRVL** ; THE TOTAL WEAPONS RELEASED IS EQUAL TO THE **QTY** SETTING.

SINGLE-CONTINUOUS (QTY POSITION C)
WITH THE BOMB BUTTON SIGNAL HELD, WEAPONS RELEASE ALTERNATELY AT THE SELECTED RELEASE **INTRVL** UNTIL THE STATIONS EMPTY OR THE BOMB BUTTON SIGNAL IS TERMINATED.

Note

WITH TWO OR MORE STATIONS SELECTED IN SINGLES MODE, THERE IS NO INDICATION WHICH STATION RECEIVES THE FIRST RELEASE PULSE, LEFT OR RIGHT. NORMALLY, THE LEFT STATION RECEIVES THE FIRST RELEASE PULSE.





PAIRS-MANUAL (QTY POSITION P)
TWO WEAPONS ARE RELEASED SIMULTANEOUSLY (FROM DIFFERENT STATIONS) EACH TIME THE BOMB BUTTON IS DEPRESSED. AT LEAST TWO (ANY TWO) STATIONS MUST BE SELECTED.

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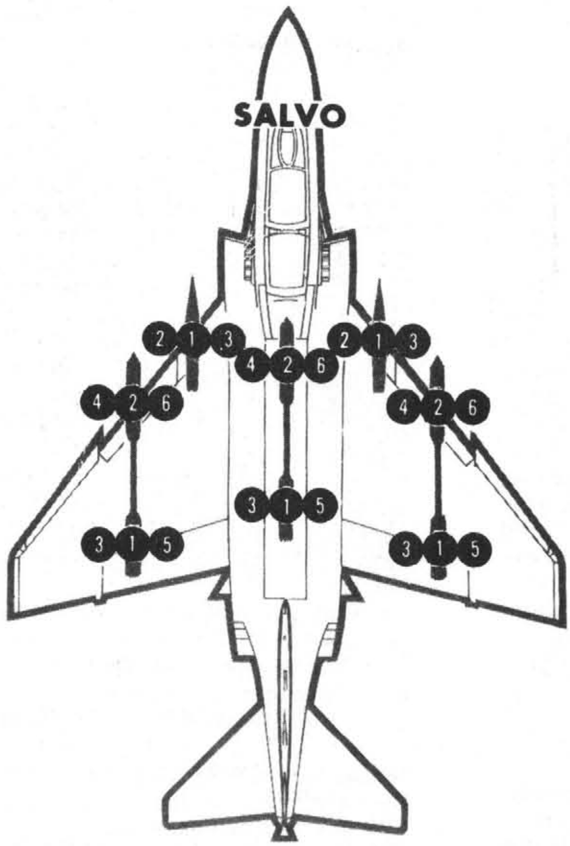
Figure 1-44C (Sheet 1 of 2)

NORMAL RELEASE SEQUENCE (continued) F-4E

5 STATIONS LOADED, 5 STATIONS SELECTED, BOMBS OR RKTS/DISP. MUNITIONS

AFTER T.O. 1F-4E-556

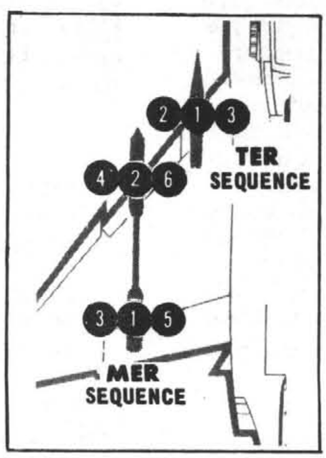


SALVO (QTY POSITION S)
WITH BOMB BUTTON SIGNAL HELD, ONE WEAPON IS RELEASED SIMULTANEOUSLY FROM EACH SELECTED STATION; THE INTERVAL BETWEEN EACH SALVO RELEASE IS EQUAL TO THE INTRVL SETTING

CAUTION

REFER TO T.O. 1F-4C-1 FOR DETAILED INFORMATION CONCERNING THE MINIMUM ALLOWABLE RELEASE INTERVALS THAT MAY BE USED WITH THE AWRU SALVO MODE.

MANUAL-SALVO (WPN SEL POSITION A)
WITH RKTS OR DISP ABOARD, ONE WEAPON IS FIRED FROM EACH SELECTED STATION WITH EACH BOMB BUTTON SIGNAL. (THE AWRU IS BYPASSED).



THE MER AND TER RELEASE SEQUENCE ALWAYS REMAINS AS ILLUSTRATED HERE. EMPTY POINTS ARE AUTOMATICALLY STEPPED OVER.

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Figure 1-44C (Sheet 2 of 2)

GUNS/MISSILE WEAPON SELECT

The guns/missile switch is a four position control which performs the weapon select function for guns, radar and heat missiles, and performs station select functions for the heat missiles. The positions are arranged as follows:

Forward - Radar Missiles
Center - Heat missiles
Rear - Guns
Up - Heat Reject (spring loaded)

There is no OFF position on the control. With master arm SAFE, one of the head-up lights illuminate simply to indicate the existing position of the guns/missile switch, either the HEAT, GUNS, or RADAR light. The A/C can cycle the guns/missile switch through the three positions and watch the three head-up weapon select lights illuminate. (This assumes the landing gear handle is up, or the armament safety override is depressed, and that the weapon selector is not in the TV or ARM positions.) Therefore, when the landing gear handle is raised, one of the lights will indicate the present guns/missile switch position. If at this point, the master arm switch is placed to ARM (with no further munition preparations) the head-up select light goes off and the ARM light comes on. This simply means that the master ARM signal is present, and that further weapon preparations are necessary. Hence, a complete nose gun or missile weapon ready indication is the illumination of both the head-up ARM light and the applicable weapon head-up light. (This does not include gun pods.)

GUNS STATION SELECT AND ARM

The nose gun station select circuits are essentially unchanged. With the guns/missile switch in guns (heads-up GUN light on), the nose gun station button is depressed to remove an interlock in the master arm circuit; the station green light illuminates. The master arm switch is placed to ARM to energize the remaining gun ready relays and enable the trigger switch circuit. Now the station ARM, and the heads-up ARM lights illuminate, along with the head-up GUN light which was already on. In this particular case, the GUN and ARM head-up lights, and the gun station amber light all provide the weapon ready indication. The ready indication cannot occur unless rounds are aboard and not limited, and the WPN SEL control is placed in some position other than TV or ARM. The TV and ARM positions completely lockout the trigger switch/gun circuits so that gun-ready cannot be obtained. (See Cage Functions, this part.)

Note

> The TV and ARM weapon selections lock out the gun, radar and heat missile fire circuits (and the respective head-up lights) unless the CAGE signal is present.

If gun pods are aboard, the head-up GUN light has no function. Only the head-up ARM light and the station ARM light provide the fire ready indication.

MISSILE STATION SELECT AND ARM

Refer to T.O. 1F-4C-34-1-1A for heat and radar missile descriptive data.

CAGE FUNCTIONS

The momentary, push button cage control is added to the inboard throttle assembly (figure 1-44A) and the AC can immediately apply the CAGE signal with minimal hand motion. The optical sight electrical cage function is removed from the control stick ARR button and relocated to the cage button. The basic purpose of the control is to rapidly switch the aircraft systems into an air-to-air operational status. Depending on the present status of the aircraft, the cage signal effects any one or all three of the following aircraft systems: the air-to-ground weapons release system, the optical sight system, and the radar system. The cage signal, as it effects these systems, may be defined by the following.

a. If the WPN SEL control is in ARM or TV, the cage signal switches the trigger into the launch circuit of whatever munition is selected by the guns/missile switch.
b. The LCOSS switches and locks-up in an air-to-air mode (if A/G was previously selected). Further operation of the sight is a function of the guns/missile switch position, and whether or not radar lockon exists.
c. With AN/APQ-120 radar power switch in any position but OFF or TEST, the cage command switches the radar into BST (transmitter ON) mode, with R1 auto-acquisition available in both cockpits. The AIR-TO-AIR light (figure 1-44B) comes on.

Notice that if WPN SEL is not in TV or ARM, then the cage command has no meaning as far as preceding step a is concerned. If the sight is already operating in the air-to-air lead compute mode (step b), the cage command does nothing more than apply the reticle stiffness (1000 ft lead compute) signal, illustrated in figure 1-50. Finally, if the radar is being operated under the conditions of step c with lockon, then CAGE has no radar function.

Note

> The AC can inadvertently break lockon by depressing the CAGE button (with the intention of obtaining sight stiffening) if the WSO is locked on in the RDR mode. Depressing the CAGE button does not break lockon if the WSO is locked on in the BST mode and in the 5-mile range.

In order to demonstrate the system, consider an example of the cage function. Suppose the aircrew is engaged in a Mark 1 Mod 0 (Walleye) mission. The appropriate operating modes (TV) are selected in both cockpits and the optical sight is in AG with the required reticle depression setting. Hence, the AC has energized DIRECT, weapon station, TV weapon select, and master ARM; before (71-237) the WSO has radar mode TV selected. The trigger and bomb button is ready in the weapon lockon/release network.

Note

In aircraft 71-237 and up, the TV position on the radar panel is functional only for radar BIT operations. The radar may be in any operating mode (or OFF) during the launch of TV guided weapons.

At this point, the head-up ARM light and station ARM light is on. The AC may set up the nose gun and observe heat missile status functions by accomplishing the following.

1. Energize nose gun station; the station green light comes on. Select the desired gun rate (Hi/Lo).
2. If heat missiles are aboard, a missile status HEAT light is on indicating the current selected station. The HEAT status light for the selected station remains on continuously regardless of the guns/missile switch position.

Note

With master ARM energized (as in this example), selecting heat on the guns/missile switch energizes AIM-4 cool start. Once initiated, cooling cannot be reversed.

3. Prior to aircraft (71-237), radar missiles cannot be tuned, nor will they maintain a tuned status with radar mode TV selected. The RDR MSL power switch may be maintained in STBY in order to have continuous missile warm-up voltage.

   In aircraft (71-237) and up, the TV position of the radar mode knob has no weapon or video display function. The AC may select CW ON and tune missiles any time during air-to-ground mission (and prior to the CAGE signal), or maintain the CW STBY position as required.

Cage, Guns Selected

In this example, what occurs with the application of the CAGE signal is evident by applying the definitions of steps a, b, and c stated previously. Therefore with guns selected on the guns/missile switch, the CAGE signal places the trigger in the nose gun network and the LCOSS switches into the 1000 ft. lead compute operating mode. If lockon occurs, the optical sight provides lead compute at radar range. The head-up GUN light, ARM light, and gun station ARM light are illuminated and the nose gun is ready to fire. In the rear cockpit, the AIR-TO-AIR light illuminates with the application of CAGE.

Cage, Heat Selected

If heat missiles are selected on the guns/missile switch, the missile/trigger network is energized and the missile tone circuits are enabled. The optical sight cages at RBL. With AIM-9's aboard, the head-up HEAT light is on immediately. With AIM-4D's aboard, the HEAT light illuminates indicating a cooled missile. Also, the seeker uncage functions of the ARR button are available. With the missile tone signal, the AC can fire. Refer to T.O. 1F-4C-34-1-1A.

Note

The AN/APQ-120 computer will compute AIM-4D launch equations with heat or guns selected and AIM-7 equations with radar selected.

Cage, Radar Selected

Considering radar missiles at CAGE, missile tuning begins when CW ON is selected. (In aircraft 71-237 and up, tuning may be accomplished prior to CAGE.) The four radar (RDR) status lights illuminate as soon as their corresponding missiles tune. (Missile tuning is independent of the guns/missile switch position or master arm.) With the guns/missile switch in radar and one or more missiles tuned, the head-up RADAR light comes on. The AC may select interlocks IN or OUT and proceed with the respective launch procedure. With the CL TK aboard light on, only the two aft missiles can be launched. At CAGE, the sight reticle locates at RBL and the AIR-TO-AIR light in the rear cockpit illuminates.

Cage, Scope Displays (Aircraft 71-237 and Up)

With the addition of the MSDG and TISEO systems, the crew may independently select either the TISEO TV, weapon TV, or the radar video on the front and rear scope indicators. (The display select controls for the AC are shown in figure 1-44A). With a TV display in progress, the CAGE signal immediately switches the forward indicator into the radar display, but the rear indicator display remains as selected by the WSO.

CAGE RESET

The cage reset capability is available in both cockpits. In the forward cockpit, the cage reset signal is applied by momentarily selecting the B position of the WPN SEL control. In the rear cockpit, the WSO may depress the AIR-TO-AIR button (figure 1-44B). In either case, the AIR-TO-AIR light goes out. The cage reset function simply returns the aircraft to the status attained prior to the application of the CAGE signal. In the example previously stated, the weapons launch, LCOSS, and radar operate modes would return to the TV weapon functions. If the AC leaves the WPN SEL in B position, this will not inhibit the radar or LCOSS cage functions, or future cage reset functions of the AIR-TO-AIR button.

AIR-TO-GROUND MISSION, TRIGGER INTERLOCKS

To further demonstrate the system, consider the situation when the mission involves the use of BOMBS or RKTS and DISP munitions deployed through the bomb button. With master arm energized, the trigger switch is HOT in the air-to-air weapon launch circuit selected on the guns/missile switch. With GUNS selected for example, the only way to SAFE the nose gun is to de-select the nose

WEAPONS RELEASE COMPUTER SET F-4E

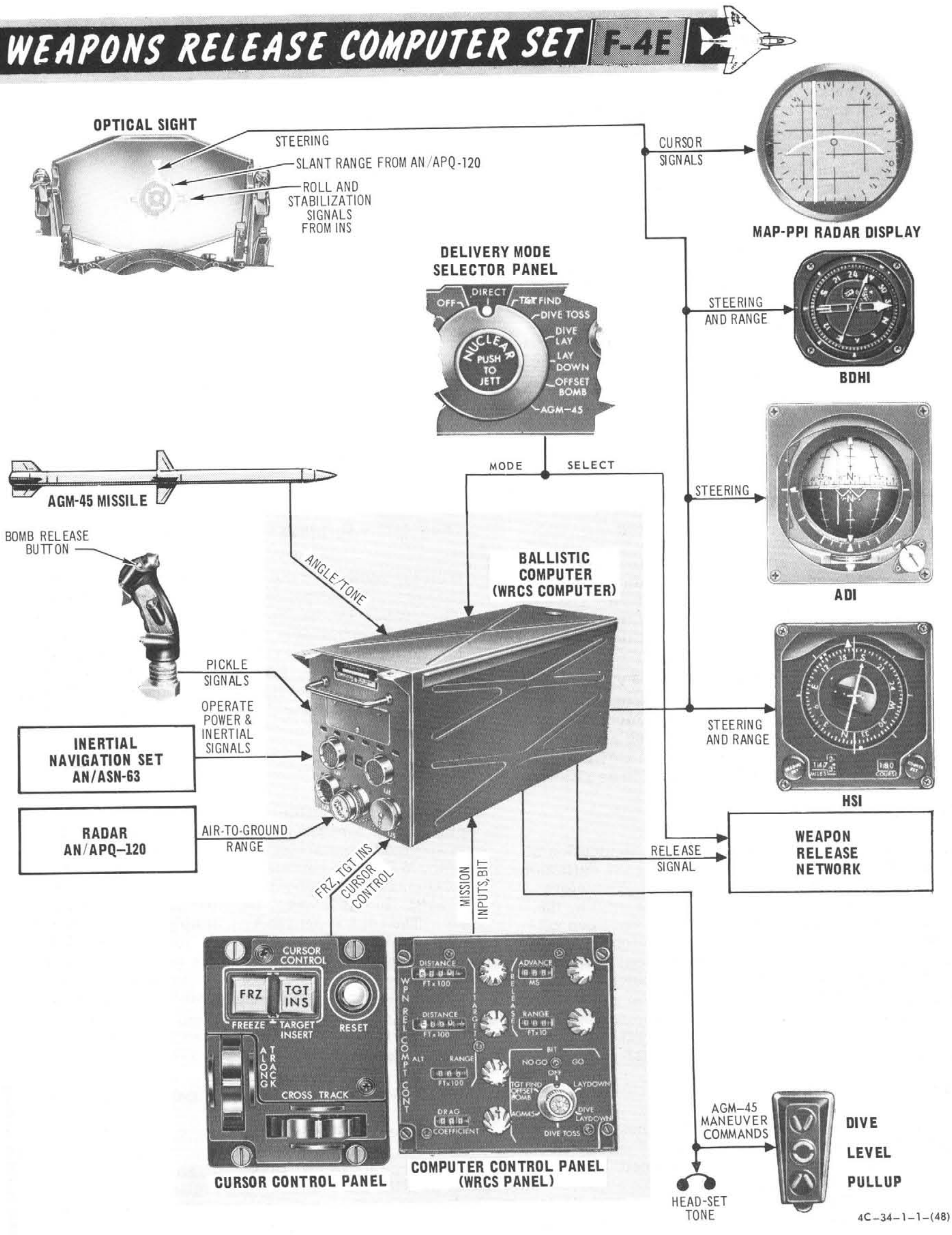

Figure 1-45

gun station. If HEAT missiles are aboard and with HEAT selected (AIM-4D cooled), there is no way to SAFE the trigger circuit except to de-select the HEAT position. With radar missiles selected and tuned (CW ON), the only way to prevent the immediate trigger-launch of radar missiles is to select interlocks IN. Therefore, when all three air-to-air munitions are aboard with master arm energized, the trigger can be rendered SAFE by selecting the gun weapon on the throttle and by maintaining the gun station selector deenergized.

There is one situation which the AC must consider during combat conditions. If it becomes necessary to rapidly switch from one air-to-air weapon to another - say from radar to guns - the AC must not become mis-oriented and hold the trigger signal while the guns/missile switch is being positioned. This would result in the accidental expenditure of needed munitions, and possible munition collisions in front of the aircraft.

WEAPONS RELEASE COMPUTER SET

The weapons release computer set (WRCS) is an analog computing weapon delivery system that provides range calculations and weapon release signals for laydown, dive laydown, dive toss, and offset bomb modes of weapons delivery. The system provides steering signals and range-to-target information for use in the target find and offset bomb modes of operation. In addition, the WRCS provides maneuver commands, distance to target, and a release signal for the AGM-45 delivery mode (figure 1-45). Finally, the system may be operated simultaneously with any LABS bombing mode, which then becomes the LABS/WRCS integrated mode. The target find mode is only a navigational mode in which the system cannot deliver a release signal. Hence, the net function of this system is to direct the aircraft to a specific ground objective (or target) along a ground track which is projected directly through the target. Each WRCS operating mode is thoroughly discussed in later paragraphs. The AGM-45 function is presented in T.O. 1F-4C-34-1-1A.

The WRCS consists of three units: the ballistics computer; the weapons release computer control panel (WRCS panel); and the cursor control panel located in the rear cockpit on the right console (figure 1-46). WRCS operating power is received from the inertial navigation set (INS) and aircraft power sources.

BALLISTIC COMPUTER ADJUSTMENTS F-4E

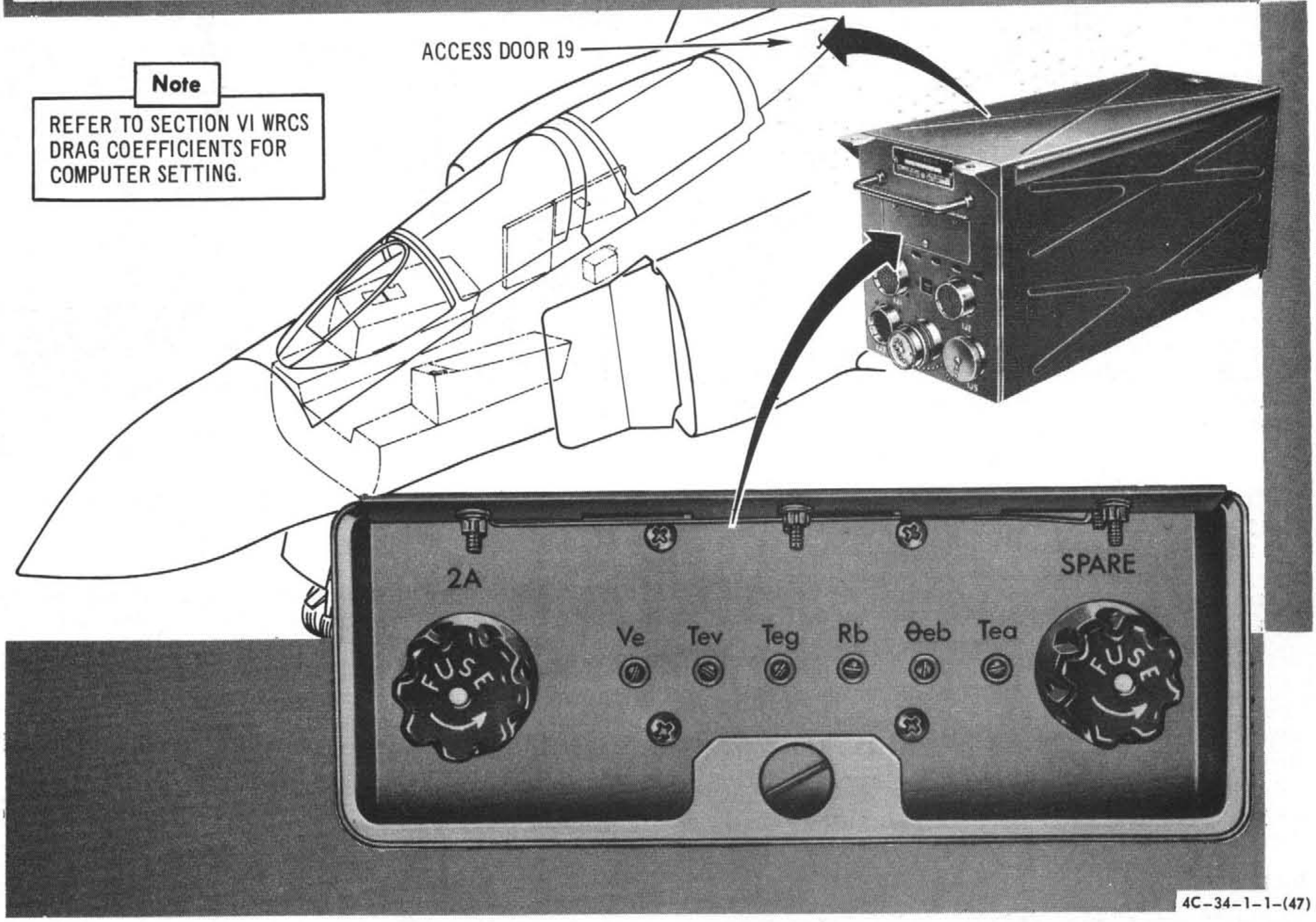

Figure 1-46

The accuracy of the weapons release computer is directly related to the input parameters received from the inertial navigation set (INS) and other associated systems when employed. The INS accuracy should be at least maintained at 5.0 nautical miles of error per hour (CEP). The ground speed indicator error (while the aircraft is not moving) should not be greater than 18 knots in 2 hours of navigation time. However, a higher degree of accuracy can be obtained which will produce greater bombing accuracy. The following suggestions are offered.

a. The accuracy of the INS should be maintained at 3 nautical miles of error per hour of CEP by checking the actual error after each flight and having the computer gyro bias adjustments made by the ground crew with the equipment installed in the aircraft. Even 2 NM/hour of CEP is obtainable.

b. After each flight, the aircrew should note the ground speed indicator error while the aircraft is not moving; the indication should not be greater than 8 knots per hour of navigation time.

Note

> Looseness in the ground speed/ground track resolver can cause an erroneous readout; however, the readout will be lower than actual and should not present a problem.

c. The INS double alignment procedure outlined in flight manual T.O. 1F-4C-1 produces greater WRCS accuracy.

d. The boresight procedures used by the ground crew should ensure that the radar boresight line and the pipper line-of-sight are parallel during the air-to-ground ranging mode.

e. The hand-set parameters on the WRCS cockpit panels and the screwdriver adjustments made to the computer must be accurate.

BALLISTIC COMPUTER, CP-805/ASQ-91

The ballistic computer (WRCS computer) is behind the rear cockpit. The computer contains all of the analog circuitry required to solve the bombing problem for each WRCS delivery mode. Built-in-test (BIT) features are incorporated to facilitate a go/no-go check of the WRCS.

The computer has several screwdriver adjustments (figure 1-46) under the dust cover plate that are made by the ground crew. These adjustments are bias factors and should not be confused with the actual parameter. For example: V_e IS NOT the ejection velocity of the bomb in feet per second; V_e is the ejection velocity bias factor that is selected and applied to the computer. The drag coefficient value (C_B which is dialed into the computer by the pilot) is also a bias factor that varies with the type of bomb and is related to specific V_e bias setting. When V_e is changed, the drag coefficient must be changed.

WEAPONS RELEASE COMPUTER CONTROL PANEL

The computer control panel (WRCS panel) has three TARGET input controls, two RELEASE input controls, and a bomb DRAG COEFFICIENT input control (figure 1-46). The panel also has a BIT control knob that is used to select and test the go/no-go status of the WRCS. Refer to figure 1-47, WRCS manual inputs.

WRCS MANUAL INPUTS F-4E

DELIVERY MODE	TARGET – FT X100				DRAG COEF-FICIENT	RELEASE	
	N/S DIST	E/W DIST	ALT	RANGE		ADVANCE MILLI-SECOND	RANGE FT x 10 FT x 100
MAX SET	999	999	100	249	9.99	999	999
DIVE TOSS					X	X	
DIVE LAY						X	X
LAYDOWN				X		X	X
OFFSET BOMB	X	X	X			X	X
TGT FIND	X	X	X				
AGM-45			X			X	
TGT FIND/ LABS	X	X	X			X	X

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Figure 1-47

Target Range Controls

The three target inputs are used for the target finding mode and the offset bombing mode. The distance between the IP (identification point) and the target, with respect to the target map coordinates, is placed on the two distance readout displays by rotating the adjacent control knobs. The distance is manually placed on the readout control and is in hundreds-of-feet. The top target distance readout control receives the north or south distance, the lower target distance control receives the east or west target distance. For the offset bomb and target find mode, the altitude value placed in the ALT RANGE control should be either (1) the target or RIP elevation MSL ± the D value for the planned run in altitude or (2) the target or RIP pressure altitude. For the laydown bombing mode, the ALT RANGE readout control receives the range from the IP to target in hundreds-of-feet. Either the ALT or RANGE placard is illuminated under the panel, depending on the delivery mode selected. The maximum setting on the target controls is 999 X 100 feet (99,900 feet). Tick marks are provided on the 100-foot dial to permit intermediate settings. The dual purpose ALT RANGE control has the following maximum settings: the maximum ALT settings is 100 X 100 feet (10,000 feet); the maximum RANGE setting is 249 X 100 feet (24,900 feet). The maximum setting on the N-S and E-W DISTANCE controls is 999 X 100 feet (99,900 feet).

CAUTION

> When a value is inserted on the target ALT RANGE counter other than 000, do not select the target finding or offset bombing mode unless; the aircraft altitude MSL is greater than the value (times 100) or, performing the target find/offset bomb WRCS BIT check as presented in section II. This is necessary to prevent possible damage to the pitch servo in the WRCS computer.

Release Range Control

The release range (R_R) control knob is used to manually set the bomb range in tens-of-feet on the digital readout. This control is used for the laydown, dive laydown, and offset bombing modes. The maximum setting is 999 X 10 feet (9,990 feet).

Note

- As described later, the (R_R) setting may be as great as 99,900 feet for WRCS/AJB-7 integrated deliveries.
- Do not set the target range control and release range control on equal values, allow at least 0.25 second time/distance between settings to allow for the maximum possible bomb rack time delay. If the values are equal, the bomb may not release or the bomb releases late.

Release Advance Control

The release advance control is operative in all WRCS bomb release modes and in the WRCS/LABS integrate mode. The release advance control can be used in conjunction with the intervalometer on the station and weapon selection panel to advance the release signal in milliseconds. For example; if the BOMBS/TRIPLE mode is selected, with a release interval of 100 milliseconds (100 MS), the WRCS normally computes the release of the first bomb-on-target. The release advance control can be used to place the second bomb on-target by setting 100 milliseconds on the digital readout; the first bomb will then hit short of the target, the third bomb will hit long of the target. The counter has a maximum setting of 999 milliseconds. The release advance setting that will place the middle bomb on target can be determined by the following equation:

For an ODD number of bombs, to place the middle bomb on target:

$$RA = I_R \frac{(N-1)}{2}$$

For an EVEN number of bombs, to place the FIRST middle bomb on target:

$$RA = I_R \frac{(N-2)}{2}$$

For an EVEN number of bombs, to place the SECOND middle bomb on target:

$$RA = I_R \frac{(N)}{2}$$

where:

RA = Release Advance Setting in milliseconds.

I_R = Release Intervalometer setting in milliseconds.

N-1 = The number of bombs released minus one bomb.

Drag Coefficient Control

The drag coefficient control is used only during the dive toss mode. The maximum setting 9.99. Refer to WRCS Drag Coefficients section VI. The drag coefficient (C_B) is a bias factor that is analytically established to equate the computer bomb trajectory to the actual bomb trajectory. This drag coefficient value is not the mathematical drag coefficient of the bomb. The ground crew must set the Ballistic Computer (CP805/ASQ-91) in door 19. When V_e is changed, the drag coefficient will change.

Built-in-Test (BIT)

The built-in-test (BIT) control is used to establish the go/no-go status of the WRCS. The BIT selector knob is not a mode selector switch for computer operation. The BIT is initiated by rotating the knob to the bombing mode to be tested and depressing the button in the center of the selector knob, placarded PUSH FOR BIT, wait 5 seconds and then depress the FREEZE button while holding the BIT button depressed. Upon receiving either a Go or No-Go placard illumination, the BIT is discontinued by releasing the button. The NO-GO and GO lights are located under the panel to illuminate the applicable placard. Illumination of the NO-GO indicator at times other than the BIT checks indicates an inertial navigation system malfunction. A NO GO indication will result if the BIT parameter (listed in the checklist) are not used. If a NO GO indication is received as the BIT button is released, the indication can be disregarded if a GO indication was previously obtained. Refer to section II, WRCS BIT check procedures.

CURSOR CONTROL PANEL

The cursor control panel (figure 1-46) contains the additional control required to perform the target-finding mode and the offset bombing mode.

Cursor Controls

The cursor control panel has two thumbwheel type cursor controls (or slew controls) placarded ALONG TRACK and CROSS TRACK. These controls are used to position the cursors that appear on the radar scopes when operated in the MAP-PPI mode. The controls are spring-loaded to return to the center position after each operation of the control; this return motion of the control does not affect the position of the radar cursors. The along track control contains a microswitch that activates a relay to enable the cursor control commands to be received by the WRCS computer. Therefore, the along track control must be moved first, and then the cross track control. Until the along track control is moved, or the freeze button is depressed, the velocity integrators in the WRCS computer are maintained at zero distance traveled. The along track control positions the range cursor over or below the RIP radar return. The cross track control positions the vertical offset cursor over the RIP radar return. The

intensity of the cursors on the scopes can be controlled by the controls located on scope panel in the rear cockpit. If the cursors appear to be erratic in track or control, push the reset button and resume operation.

Note

Do not position the range cursor below zero range. If the range cursor is moved below zero range and positioned over the IP, the steering information will be in error by 180 degrees and the cursor will respond opposite to along track cursor control movements.

Freeze Button

When the freeze button is energized, the velocity integrators in the WRCS computer begin to calculate the distance traveled from zero, and the cursors begin tracking the ground position indicated on the radar scopes by the intersection of the two cursors. The freeze button remains illuminated until the reset button is depressed, or until a different delivery mode is selected. The freeze button is used also during the BIT check to initiate the test problem for all bombing modes.

Target Insert Button

When the TARGET INSERT button is energized, the north-south and east-west distances (entered in the WRCS panel controls) are inserted into the WRCS computer. This action causes the cursors to move from the RIP to the target and begin tracking the target location on the radar scope. Only at this point is target steering information supplied to the various display instruments. The target insert button remains illuminated until the reset button is depressed, or until a different delivery mode is selected.

Reset Button

The reset button is a momentary pushbutton switch spring-loaded to ON. Depressing the reset button deenergizes the tracking relays and causes the velocity integrators to return to zero distance traveled; the freeze button light and the target insert button light go out; the offset cursor on the radar scope moves to the center of the scope; the range cursor disappears. The purpose of the reset button is to permit the aircrew to cancel all previous inputs and start over. This might be desirable when the RIP can be visually located and a fly-over fix on the RIP accomplished. When the aircraft is directly over the RIP, the pilot pushes the freeze button to energize the velocity integrators. If immediate steering information is required, the pilot should depress the target insert button as soon as possible after depressing the freeze button.

LEAD COMPUTING OPTICAL SIGHT

The lead computing optical sight system (LCOSS) provides a sight aiming reference for air-to-air and air-to-ground methods of weapon deployment. The sight system also provides steering indications for certain WRCS modes of operation and performs as an indicator for certain LABS delivery modes. The specific operating mode of the sight system is governed by the position of the delivery mode selector on the main instrument panel. The sight unit is mounted on the front cockpit radar scope. A red reticle image is projected on a combining glass to serve as the visual sight reference. The sight can be depressed vertically from zero mils to 245 mils below the fuselage reference line. The sight is depressed by rotating the reticle depression knob until the digital readout (in one-mil increments) corresponds to the desired sight setting. The sight cannot be manually positioned in azimuth.

Power is applied to the lead computing sight components and the gyroscope when the sight mode selector knob is in any position except OFF. In STBY, the sight reticle is mechanically caged, but not illuminated. In CAGE, the sight reticle is illuminated and mechanically caged to the radar boresight line (RBL). The radar boresight line is located 35 mils below the fuselage reference line; therefore, the optical sight setting is 35 mils, regardless of the reticle depression knob setting. The optical sight is mechanically caged when the sight mode selector knob is positioned to OFF, STBY, or CAGE.

The optical sight has two modes of operation: A/G (air-to-ground) and A/A (air-to-air). Variations of the two basic modes are controlled by the position of the delivery mode selector. Figure 1-48 is a table of optical sight functions vs the selection of the various delivery modes before the modification of T.O. 1F-4E-556. Figure 1-49A is a table of optical sight functions after T.O. 1F-4E-556.

The reticle image is composed of a fixed reticle, roll reference tabs, and a range bar (figure 1-49). The fixed reticle consists of a two-mil diameter pipper located in the center of a 25-mil diameter segmented circle, and a 50-mil diameter complete circle. The 50-mil circle has three index tabs located on the outer edge at the top, and left and right of the pipper. The roll reference tabs rotate about the 50-mil circle and basically have two separate functions. During the offset bombing mode and the target finding mode, the roll tabs provide steering information supplied by the WRCS. The position of the roll tabs, with respect to the fixed index tabs, indicates the angle between the ground track and course to the target. During all other modes of operation, the roll tabs indicate the aircraft roll attitude which is supplied by the INS.

The range bar is semi-circular and appears on the inside of the 50-mil circle only when a target has been acquired by radar lock-on. The instantaneous length of the range bar, and the rate at which the length is changing indicates the actual radar slant range and the range rate between the aircraft and the target. The maximum length of the range bar is equal to 170° of arc; or from the 6 o'clock (minimum range) position to the 12:30 (maximum range) position with A/A selected on the sight mode knob. With

OPTICAL SIGHT FUNCTIONS F-4E

DESIRED DELIVERY	WEAPON SELECTOR KNOB	DELIVERY MODE SELECTOR (5)	SIGHT MODE SELECTOR KNOB	OPTICAL SIGHT RETICLE			
				ELEVATION	AZIMUTH	ROLL TABS	RANGE BAR
Guns A/A	GUNS	(1) NA	A/A	Lead Compute	Lead Compute	Roll	Max Range 6700 ft
Guns A/G	GUNS	OFF or DIRECT	A/G	Manual Dep. from FRL	Caged at 0°	Roll	
Rockets	RKTS & DISP	(4) DIRECT	A/G	Manual Dep. from FRL	Caged at 0°	Roll	
Tgt. Find	(7) NA	TGT FIND	A/G	Caged at RBL	Caged at 0°	(2)	
Dive Toss	(7) NA	DIVE TOSS	A/G	Caged at RBL	Drift	Roll	
Dive Laydown	(7) NA	DIVE LAY	A/G	Caged at RBL	Drift	Roll	
Laydown	(7) NA	LAYDOWN	A/G	(3)	Drift	Roll	
Offset Bomb	(7) NA	OFFSET BOMB	A/G	Caged at RBL	Caged at 0°	(2)	Max Range 20,000 ft
LABS Bombing	(7) NA	TIMED LEVEL, TIMED LADD, TIMED O/S, LOFT, or INST O/S	A/G	(3)	Caged at 0°	Roll	
Direct Bombing	BOMBS or RKTS & DISP	DIRECT	A/G	Manual Dep. from FRL	Caged at 0°	Roll	
AGM-12 or AGM-62	AGM-12 or AGM-62	DIRECT	A/G	Manual Dep. from FRL	Caged at 0°	Roll	
AGM-45	AGM-45	AGM-45	A/G	Caged at RBL	Caged at 0°	Roll	
Missiles Air-to-Air	(8)	(6) OFF	A/A	Caged at RBL	Caged at 0°	Roll	

RBL = Radar Boresight Line FRL = Fuselage Reference Line. NA = Not Applicable.

(1) The lead computing function of the optical sight reticle is not altered by the delivery mode selector panel selection, nor by the selection of GUNS & STORES. The master arm switch must be in ARM (see T.O. 1F-4E-534). When the ARR button is held depressed, the lead angle computer receives a fixed 1500 foot range signal; the range bar continues to indicate the actual slant range, or the maximum displayable range of 6700 feet.

(2) The roll tabs display roll attitude until Target Insert, then the roll tabs display steering commands to the target.

(3) The sight reticle is pitch stabilized; manual depression is from the level plane (the local horizontal). If INS fails during LABS mode, the AN/AJB-7 reference system must be used; switch the attitude reference system selector knob to STBY for reliable sight depression.

(4) Only DIRECT position can be used to fire rockets.

(5) The function of the optical sight depends upon the delivery mode selector panel selection (except for GUNS).

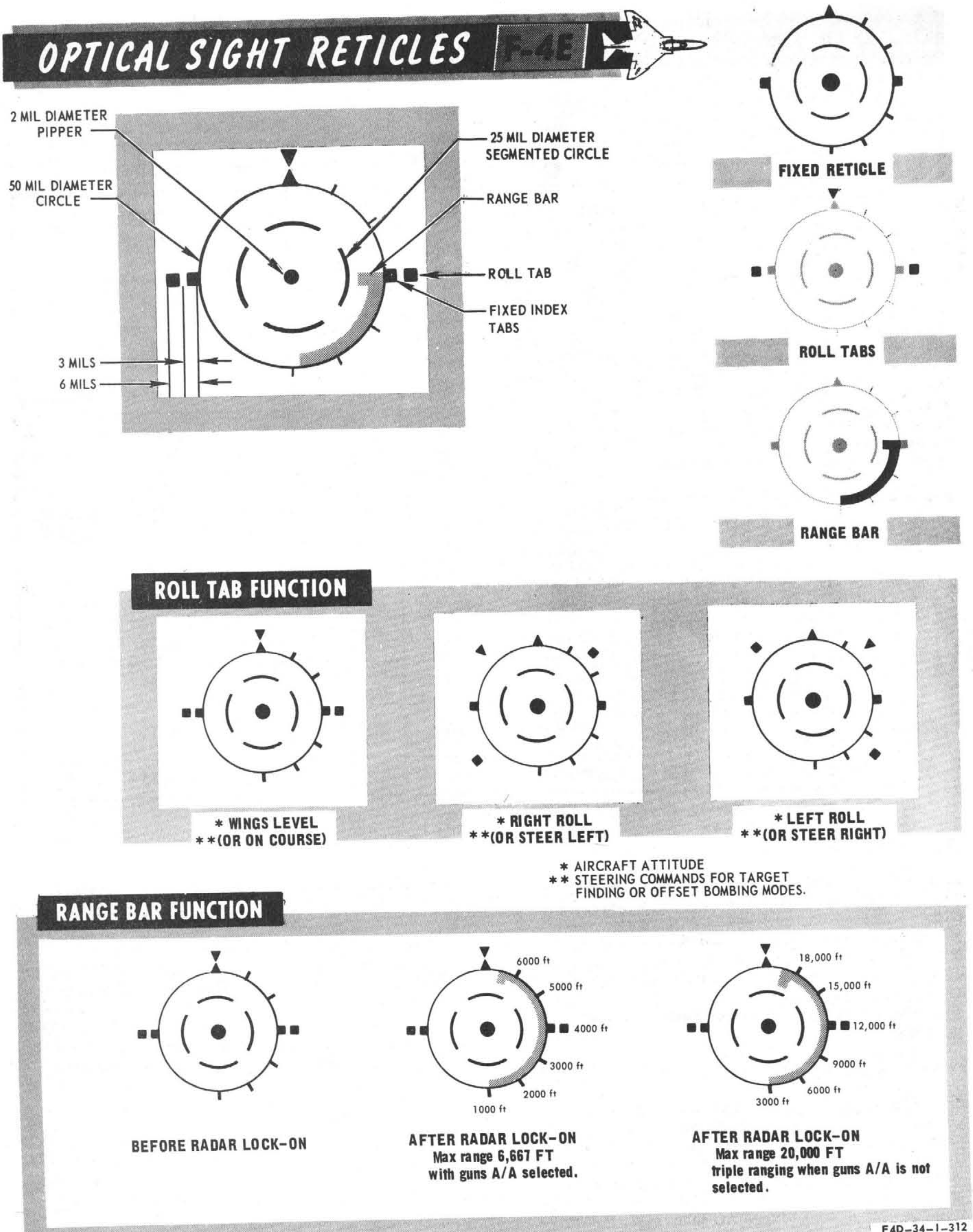
(6) The OFF position should be selected; however AIM missiles can be launched with any position selected except LABS. The function of the optical sight is not affected when air-to-air mode is selected.

(7) If weapon selector knob is in GUNS, the sight functions as a combination of the delivery mode selected and GUNS A/G.

(8) If GUNS or GUNS & STORES is selected, the master arm switch must be in SAFE to launch air-to-air missiles.

4C-34-1-1-(50)

Figure 1-48



OPTICAL SIGHT RETICLES
F-4E
2 MIL DIAMETER PIPPER
50 MIL DIAMETER CIRCLE
3 MILS
6 MILS
25 MIL DIAMETER SEGMENTED CIRCLE
RANGE BAR
ROLL TAB
FIXED INDEX TABS
FIXED RETICLE
ROLL TABS
RANGE BAR
ROLL TAB FUNCTION
* WINGS LEVEL
**(OR ON COURSE)
* RIGHT ROLL
**(OR STEER LEFT)
* LEFT ROLL
**(OR STEER RIGHT)
* AIRCRAFT ATTITUDE
** STEERING COMMANDS FOR TARGET FINDING OR OFFSET BOMBING MODES.
RANGE BAR FUNCTION
6000 ft
5000 ft
4000 ft
3000 ft
2000 ft
1000 ft
18,000 ft
15,000 ft
12,000 ft
9000 ft
6000 ft
3000 ft
BEFORE RADAR LOCK-ON
AFTER RADAR LOCK-ON
Max range 6,667 FT
with guns A/A selected.
AFTER RADAR LOCK-ON
Max range 20,000 FT
triple ranging when guns A/A is not selected.
F4D-34-1-312

Figure 1-49

gun weapons selected and with the range bar at the 6 o'clock position, the actual range is 1000 feet. When the range bar tab is at the 5 o'clock position the range is 2000 feet. The range indication is linear: i.e., 1000 feet per each number on the face of a clock. When the range bar reaches its maximum length, (near the 12 o'clock position), the radar range is 6667 feet If the range is greater than 6667 feet, the range bar will remain at the maximum position.

Note

After T.O. 1F-4E-534, the lead compute mode of the opticle sight may be obtained with the master arm switch in SAFE.

When any other weapon or delivery method is selected (except guns), the minimum range position represents 3000 feet; the maximum range position of the bar represents 20,000 feet (See figure 1-49 for a summary of all sight operating modes.) The AC may, knowing the wingspan of a target aircraft, use the 25 and 50 mil diameter reticle rings as a quick range reference in the air-to-air gunnery environment. (Wingspan vs. range is explained in part 4.)

RETICLE CAGING (BEFORE T.O. 1F-4E-556)

Air Refueling Release (ARR) Button

The ARR button is used (after radar lockon) to stabilize the optical sight in the guns air-to-air lead computing mode. In air-to-air mode, the sight reticle moves in azimuth and elevation to display the lead angle required. Before radar lockon a pseudo-range of 1500 feet is supplied to the lead angle computer; the range bar is not displayed. After radar lockon, the actual slant range to the target is supplied to the computer and displayed by the range bar. When lockon is accomplished at long ranges, the sight reticle is over sensitive due to range, high G forces and/or constant maneuvering flight. The sensitivity of the reticle can be reduced by depressing and holding the ARR button. When the ARR button is held depressed, the lead angle computer receives a fixed 1500-foot range signal (figure 1-50); the range bar continues to indicate the actual slant range, or the maximum displayable range of 6700 feet. When the trigger transfer relay is energized by selecting guns, the function of the ARR button is also transferred to provide reticle caging. The ARR button will not activate the AIM-4D coolant supply. The missile arm switch and missile select switch may be in any position.

Other Sight Functions

The sight reticle may be used as an indicator for the various bombing modes. For example, the sight generally functions along with the pullup light during LABS bombing modes (a release indicator). The sight flashes (ON-OFF) indicating an INS failure, which means that the WRCS is inoperative. The reticle light also flashes if the AC inadvertently releases the bomb button during automatic bomb release modes where the release button signal must be held continually (bomb run abort indicator).

RETICLE CAGE (AFTER T.O. 1F-4E-556)

Throttle Cage Button

The sight cage function is removed from the control stick ARR button and added to the cage button on the inboard throttle. With the sight operating in the lead compute (GUNS) A/A mode, the CAGE signal essentially applies the same functions as the ARR button, except the fixed range value is changed. With range lockon, the CAGE signal energizes the reticle stiffness circuits and the sight computes lead for a target range of 1000 feet.

Note

The AC can inadvertently break lockon by depressing the CAGE button (with the intention of obtaining sight stiffening) if the WSO is locked on in the RDR mode. Depressing the CAGE button does not break lockon if the WSO is locked on in the BST mode and in the 5-mile range.

If the sight is being operated in the A/G mode, then the CAGE signal provides complete sight switching to the A/A mode. The CAGE signal switches the sight into that A/A mode which corresponds to the position of the guns/missile switch. With missiles selected, the sight reticle cages at RBL. With guns selected and while the cage button is held in, the reticle switches to RBL. As cage is released, the reticle goes to lead compute; either the 1000 foot fixed range or the radar range if lockon is present (figure 1-49A).

LOFT BOMBING EQUIPMENT

The loft bombing delivery mode is conducted using the following equipment:

a. Attitude director indicator (ADI).
b. Accelerometer.
c. Pullup light.
d. Bomb release angle computer (Low Angle).
e. Bombing timer (Pullup Timer).
f. Delivery mode selector knob.
g. Pedestal panel.
h. Bomb release button (pickle button).

The following describes system components which have not been described elsewhere.

ATTITUDE DIRECTOR INDICATOR (ADI)

The ADI aids the AC in establishing and maintaining a constant G pullup maneuver. The pointers are programmed to move out of center when the aircraft is not following the programmed pullup profile of 4.0 G obtained in 2 seconds and maintained thereafter, and a wings-level pullup. When the loft bombing mode is performed by using a pullup acceleration of 3.0 G obtained in 2 seconds, the ADI should not be used; use the aircraft accelerometer.

During the loft bomb run with the bomb mode switch on LOFT, the vertical and horizontal pointers program the flight path. Prior to actuating the bomb button, the vertical needle is deflected out of view if the navigation function selector knob is in the ATT position.

OPTICAL SIGHT FUNCTIONS F-4E

AFTER T.O. 1F-4E-556

<table>
<tr><th rowspan="2">DELIVERY/ MUNITION SELECTED</th><th rowspan="2">WPN SEL POSITION</th><th rowspan="2">DELIVERY MODE SELECTOR</th><th rowspan="2">OPTICAL SIGHT MODE</th><th colspan="4">OPTICAL SIGHT RETICLE</th></tr>
<tr><th>ELEVATION</th><th>AZIMUTH</th><th>ROLL TABS</th><th>RANGE BAR</th></tr>
<tr><td rowspan="2">GUNS</td><td rowspan="2">Any except TV/ARM</td><td>NA</td><td>1 A/A</td><td>Lead Compute</td><td>Lead Compute</td><td rowspan="4">Roll</td><td>Max Range 6700 ft</td></tr>
<tr><td>OFF or DIRECT</td><td>2 A/G</td><td>Manual Dep. from FRL</td><td rowspan="3">Caged at 0°</td><td rowspan="10">Max Range 20,000 ft</td></tr>
<tr><td>Heat or Radar Missiles</td><td>Any except TV/ARM</td><td>NA</td><td>A/A</td><td>Caged at RBL</td></tr>
<tr><td>Rockets, GP Bombs, AGM-12</td><td>BOMBS, RKTS & DISP, AGM-12, or A</td><td>DIRECT</td><td rowspan="8">3 AG</td><td>Manual Dep. from FRL</td></tr>
<tr><td>Target Find</td><td>NA</td><td>TGT FIND</td><td rowspan="2">Caged at RBL</td><td rowspan="2">Caged at 0°</td><td rowspan="2">4</td></tr>
<tr><td>Offset Bomb</td><td>BOMBS, RKTS & DISP or A</td><td>OFFSET</td></tr>
<tr><td rowspan="2">Dive Toss, Dive Laydown, Laydown</td><td rowspan="2">BOMBS, RKTS & DISP or A</td><td>DT
DL</td><td>Caged at RBL</td><td rowspan="2">Drift</td><td rowspan="5">Roll</td></tr>
<tr><td>L</td><td>5</td></tr>
<tr><td>Timed or AN/AJB-7</td><td>BOMBS, RKTS & DISP or A</td><td>TL
T LAD
O/S
LOFT
INST O/S</td><td>5</td><td rowspan="3">Caged at 0°</td></tr>
<tr><td>AGM-45</td><td>6 ARM</td><td>AGM-45</td><td>Caged at RBL</td></tr>
<tr><td>MK 1 Mod 0</td><td>6 TV</td><td>DIRECT</td><td>Manual Dep. from FRL</td></tr>
</table>

1 With lockon, the CAGE signal (held in) applies the reticle cage, 1000 ft. fixed range, lead compute mode. Without lockon, the CAGE signal (held in) places the reticle at RBL.

2 A momentary CAGE signal switches the sight to A/A lead compute mode, either 1000 ft. range or at RDR range if lockon is present (switching occurs as the CAGE button is released).

3 A momentary CAGE signal switches the sight to the A/A mode: either caged at RBL with HEAT/RDR missiles selected; or lead compute with GUNS selected.

4 Roll displayed until target insert, then steering to target.

5 The sight reticle is pitch stabilized; manual depression is from the level plane. If INS fails (reticle flashes*), the AN/AJB-7 reference system must be used; switch the altitude reference system selector knob to STBY for reliable sight depression.

6 The CAGE signal places trigger circuit into either GUNS or HEAT/RDR missile fire network; the sight functions as stated in note 3.

* The sight reticle flashes if INS fails; at AN/AJB-7 or WRCS mission abort, or with bomb button power loss. The CAGE signal deenergizes the reticle flasher.

4C-34-1-1-(216)

Figure 1-49A

Note

For LOFT mode of LABS delivery, the pedestal panel REJECT switch should be in DF REJ, or else the weapon selector must not be in the AGM-45 mode. This is necessary to get the ADI vertical pointer into the LOFT network.

When the bomb button is depressed, the vertical pointer centers - presenting the roll signal and indicating flight path deviations while the pullup timer is operating. At pullup, when the pullup timer is complete, the resolved yaw/roll signal is presented on the vertical pointer. If the pointer deflects to the right during the pullup, the AC rolls to the right-correcting into the pointer. The vertical director warning flag appears or disappears to indicate the degree of TACAN signal strength. Therefore, the appearance of the flag has no meaning with respect to the vertical pointer in a bombing mode.

The horizontal pointer is always deflected out of view unless the loft bomb run is in progress (bomb button depressed). The pointer indicates deviations in the 1.0 G flight path during the low level approach to the pullup point. When the pullup timer is complete, horizontal pointer movement represents error between the desired pullup G program and actual load factor which is measured by the accelerometer. Note that the system actually programs the proper G build-up rate, which means that if the AC increases G loading at the proper rate, the pointer will never move from the center of the sphere. The pointer continues showing error in the constant 4.0 G flight path until pilot releases the bomb button after final bomb release.

The ADI OFF flag comes into view if: (1) a system ac or dc power failure occurs; (2) there is excessive error in the roll and pitch signal sources of the gyroscope assembly; (3) an ADI failure or an internal dc failure within the ADI occurs. The OFF flag indicates malfunctions of the ARBCS only, regardless of the mode the AC has selected (PRIM or STBY) on the compass control panel. If the gyro system fails in some manner (as suggested by conditions 1 and 2 above), the aircrew cannot expect to obtain an accurate bomb release since release occurs through the ARBCS pitch following system.

BOMB RELEASE ANGLE COMPUTER

The release angle computer contains the high and low angle release switches, the drum shaft and yaw/roll resolver, and the drogue switch. The pitch inputs drive the drum shaft which actuates the high and low angle release switches. The yaw and roll inputs are resolved, as a function of pitch, and transmitted to the flight director bombing computer for use in the vertical director pointer network. The controls on the front of the computer are available in the rear cockpit. The Low Angle control may be set from 0° to 89.9°, and the High Angle control may be set from 70° to 179.9°. Only the Low Angle control is used for loft bombing.

WARNING

When the LABS release angle gyro is set greater than 169.0°, bomb release may occur at the pullup point when the bomb button is depressed (INST O/S) or at the completion of the Pull Up Bombing Timer (TIMED O/S).

FLIGHT DIRECTOR BOMBING COMPUTER

This unit develops dc voltages, which are proportional to yaw/roll and G error, for steering indications in the loft bombing maneuver. The unit also contains the tone generator which provides the pullup tone in the headset. By removing a cover plate, controls are available to set tone level, roll sensitivity, yaw sensitivity, and pitch and G error sensitivity. The sensitivity controls govern the ADI horizontal and vertical pointer rate of deflection with respect to yaw/roll and G error signals. The flight director computer contains a roll cancel relay which is energized if roll error (yaw/heading change) exceeds 30° during the pullup flight path. With the roll cancel circuit energized, the release circuit cannot be energized and the bomb run is cancelled. To ready the system for another run, momentarily position the delivery mode selector knob out of the selected function then back to LOFT.

BOMBING TIMER (DUAL TIMER)

The dual timer controls include the pullup and release setting control knobs in the rear cockpit. The pullup timer may be set from 0 to 60 seconds and the release timer within limits of 0 to 30 seconds, each in 0.1 second increments. The minimum setting for either timer is 0.1 second. The setting references in the windows do not move during the application of timer voltage in the bomb run. This is a solid state timer. Voltage is applied only to the pullup timer in the LOFT or TIMED O/S modes. In the TIMED LEVEL and TIMED LADD mode, both timer circuits are energized, providing the pullup timer is not set on zero. In the TIMED LEVEL and TIMED LADD modes, the release timer must be set to obtain the release signal. (The release timer may be set on zero for the LOFT and O/S modes.) Completion of the pullup timer energizes relays which provide the various pullup signals and the pullup flight path program. The bombing timers installed in these aircraft do not provide a pullup warning tone; only the steady tone is available.

Note

The AN/AJB-7 tone will transmit over the air unless the tone cutoff switch is placed to TONE OFF.

WEAPON DELIVERY MODES (F-4E)

AIR-TO-AIR GUNNERY

The following aircraft equipment comprise the F-4E air-to-air gunnery capability.

a. M61A1 Nose Gun and/or SUU-16/A SUU-23/A Gun Pod.
b. AN/ASG-26 Lead Computing Optical Sight System (LCOSS).

The aircraft systems listed below are electrically interfaced with the optical sight system in support of the air-to-air lead computing mode.

a. AN/ASN-63 Inertial Navigation Set.
b. A24G-34 Air Data Computer Set.
c. AN/APQ-120 Radar Set.

In the lead computing mode, the sight system solves for a predicted point of impact by developing a solution to the vector diagram shown in the upper part of figure 1-50. The solution is computed in terms of aircraft azimuth and elevation coordinates, not earth coordinates. The net az-el solution is a function of trajectory shift, gravity drop, and kinematic lead vectors. The resultant is the lead angle, which is the angle formed between the gun bore line and the pipper sight line with the pipper on target. The vectors are briefly defined below.

TRAJECTORY SHIFT

Trajectory shift occurs because the gun bore line and the aircraft flight path are not the same. The line of departure of the bullets therefore forms an intermediate path which is a function of the gun muzzle velocity vector, the aircraft flight path vector, and the included angle. Since trajectory shift lies in the pitch plane of the aircraft, the sight gyro system is calibrated (a fixed setting for each altitude and range) to correct for trajectory shift in the elevation network.

GRAVITY DROP

Gravity drop is a function of bullet time of flight and the force of gravity. A correction for gravity is also applied by a fixed calibration to circuits of the lead computing gyro. In maneuvering flight, the components of gravity lie in both the azimuth and elevation planes. Therefore, the calibration effects the az-el network.

KINEMATIC LEAD

The kinematic portion of the problem involves lead computations which compensate for the continuous change in position (or motion) between the target and the interceptor. This portion of the vector diagram lies in a plane which includes the velocity vector of the target and the position of the interceptor. The computation is a direct function of the motion of the interceptor in the pitch (elevation) and yaw (azimuth) planes. Considering the flow diagram (figure 1-50), the gyro magnet axis is fixed and lies parallel to the radar boresight line (RBL). In maneuvering flight, the magnet axis follows RBL while the gyro resists any change in direction. Since the gyro dome rotates directly in the magnetic field, an increase or decrease in magnet current strength has a sensitivity (precession) effect on the position of the gyro. For example, an increase in magnet current strength—which occurs with a decrease in radar range—causes the gyro spin axis to precess and align more closely with the magnet axis. The resultant gyro motion, which is transmitted to the optical sight reticle, becomes a reduction in the indicated azimuth and elevation lead as the aircraft closes with the target. As figure 1-50 shows, the inputs which affect magnet current strength are radar range (or the fixed reticle cage signal) and air density from the air data computer (ADC). After T.O. 1F-4E-560, ADC angle of attack and TAS are added inputs to enhance lead computer operations against maneuvering targets.

Compensations for acceleration are accomplished in a similar manner as described above. Current flow in the accelerometer network applies a restraining force to the gyro gimbal, which in turn causes the gyroscope to precess in elevation and increases gyro sensitivity. Hence, an increase in normal acceleration causes an increase in the indicated elevation lead angle.

To summarize optical sight lead functions, the azimuth-elevation lead computations are applied in terms of aircraft coordinates. Correction factors are applied to influence both the gyro azimuth and elevation output for range and air density. The elevation (pitch) output is influenced by normal acceleration from the accelerometer circuits. The net optical sight corrections are these plus the calibrations for gravity drop and trajectory shift. As the flow diagram shows, the sight system provides lead data for the constant 1500 foot range when radar lockon is lost or when the AC actuates electrical cage. After T.O. 1F-4E-556, the cage signal fixed range input is 1000 feet. With radar lockon, range data is always available to the reticle range bar when range is within the limits of 900 and 6700 feet. However, the sight computes lead for a maximum range of 4000 feet. Roll reticle signals are applied directly from the INS gyro platform.

In a typical lead pursuit firing pass, the position of the pipper on the combining glass is of little importance while the aircraft is well outside the tracking range. For any one set of maneuvering conditions, the greater the range, the greater the instability of the sight reticle. Hence, reticle cage may be applied until the AC can reach a tracking range (4000 feet or less). The most important single factor which the AC must properly control is aircraft acceleration. As the AC tracks and pulls the pipper (from a point aft of the target) up into the target, acceleration build-up rate should be constant. Then the act of stabilizing the pipper on target is a matter of holding a G that has already been obtained, and for which the sight has already compensated.

OPTICAL SIGHT SIGNAL FLOW F-4E

AIR-TO-AIR MODE

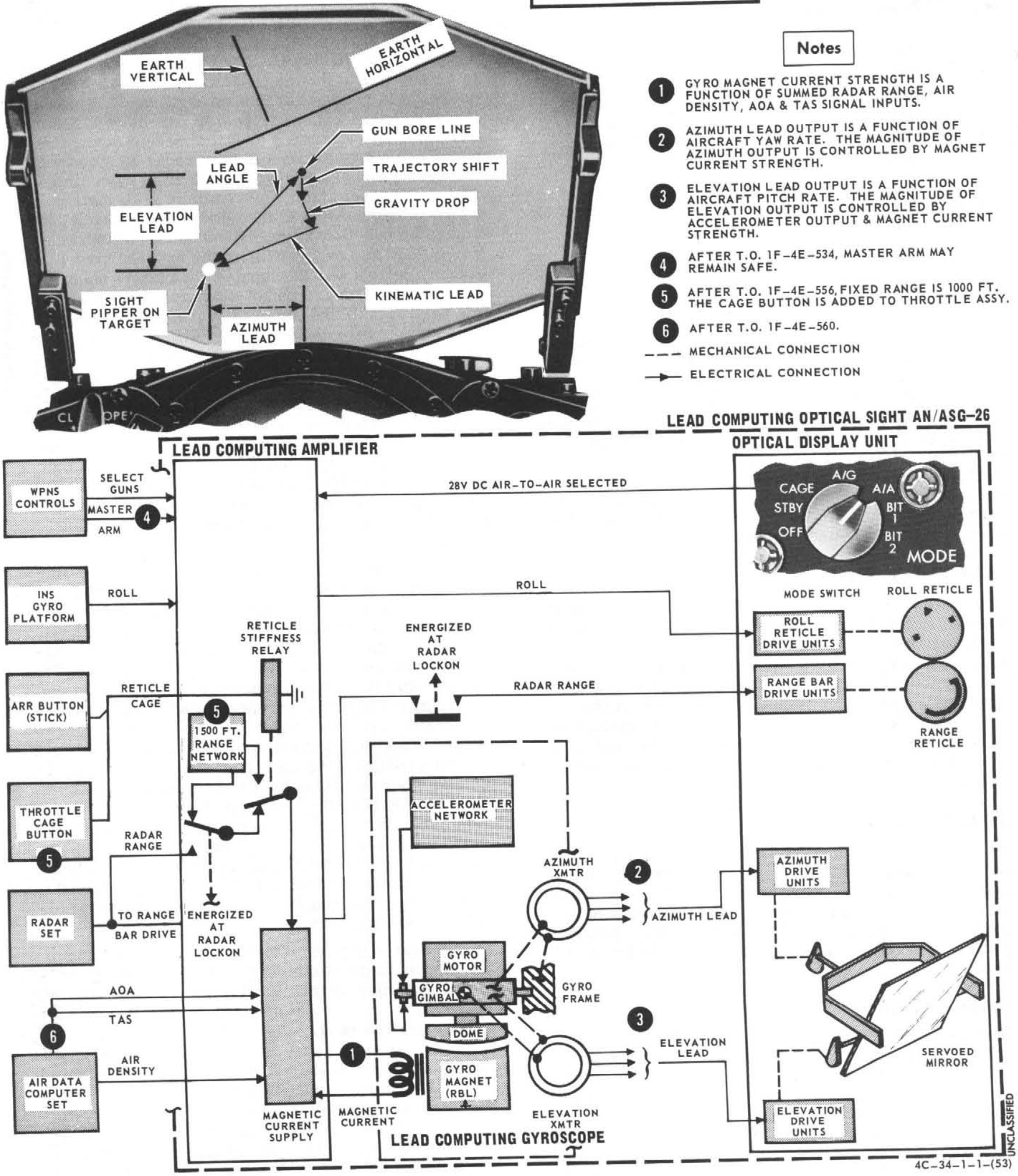


Figure 1-50

The guns are selected for firing as stated previously. The AC selects GUNS, selects the required stations(s), and selects master arm. The weapon fires as the AC delivers the trigger signal.

NOSE GUN SYSTEM, M61A1

The internal gun system comprises an assembly of units in the aircraft nose section as figure 1-51 indicates. The 20mm weapon is a complete palletized package which may be downloaded for maintenance purposes and replaced by another complete assembly. The system is electrically controlled and hydraulically powered with a capability of two rates of fire; the AC may select firing rates of either 6000 SPM (shots per minute) or 4000 SPM. The total ammunition capacity of the system is 639 rounds. The following list includes some of the major components of the gun system and the associated aircraft power requirements.

a. The M61A1 gun.
b. The ammunition drum, including the mechanically driven entrance and exit units and feed chutes which accomplish munition transfer.
c. Hydraulically operated gun scavenge system, which removes gun gas from the gun compartment by opening the scavenge door during and approximately 30 seconds after each gun burst.
d. The gun purge system, which applies engine bleed air to an ejector system to remove gas directly from the gun breech. The purge system functions during and 30 seconds after each gun burst.
e. The gun hydraulic system, which consists of a solenoid controlled two-level flow valve in the aircraft; a solenoid operated gun control valve which also functions as a brake during gun deceleration; and a hydraulic motor which drives the gun. The aircraft utility hydraulic system is used to operate the gun system.
f. The gun control unit - an electrical control network which contains the necessary circuits to disperse gun operate and fire signals. The control unit receives aircraft voltage through energized cockpit gun controls, gun power circuit breakers, and the trigger switch.

SYSTEM COMPONENTS AND OPERATION

The AC operates the gun system through the nose gun select, station select, and master arm controls on the pedestal panel. Gun master arm voltage is available only if the landing gear handle is UP.

Ammunition Drum and Conveyor System

The drum assembly (figure 1-51) provides the storage area for the 20mm ammunition and is directly linked to the ammunition feed conveyor system and the return conveyor system. Each conveyor system is identical and contains an exit unit for removing ammunition from the drum, and an entrance unit for returning spent round cases into the drum. The inner drum assembly, which is mechanically driven, rotates and drives ammunition along drum partitions and into the exit unit. The exit unit removes the rounds from the drum partitions and passes them on to the conveyor which supplies them to the gun feed assembly. After firing, the conveyor system directs spent cases (and cleared rounds) to the drum entrance unit. The entrance unit returns the rounds into the drum partitions. Hence, the complete ammunition cycle forms a closed loop.

The drum exit unit contains a last round sensing switch. When empty rounds appear in the path of the exit unit, the switch opens and automatically deenergizes the trigger fire circuit to stop gun operation. This also deenergizes the nose gun station select amber light.

Hydraulic Drive Assemblies

The utility hydraulic system supplies the power to operate the gun system at firing rates of 4000 or 6000 SPM. The rate of fire is controlled by a two-speed hydraulic flow control valve in the aircraft, which in turn is controlled by the Rate switch on the pedestal panel. The application of the trigger signal opens the gun control valve which allows power to drive the gun system through the hydraulic motor and gearbox.

Scavenge System

The gun compartment scavenge system includes a scavenge door on the upper surface of the aircraft nose section and the associated valve and linkages that apply utility hydraulic system pressure to the door operating valve. The door is held closed by hydraulic pressure. The trigger signal drops electrical power from the valve which removes the hydraulic lock and the door opens by spring force. The door remains open during gun firing and for approximately 30 seconds after trigger release. If the AC deenergizes the gun select/arm controls during the 30 second period, the door will close. With the door open, the atmosphere within the nose section completely changes at a rate of 1.0 to 2.0 times per second depending on present airspeed.

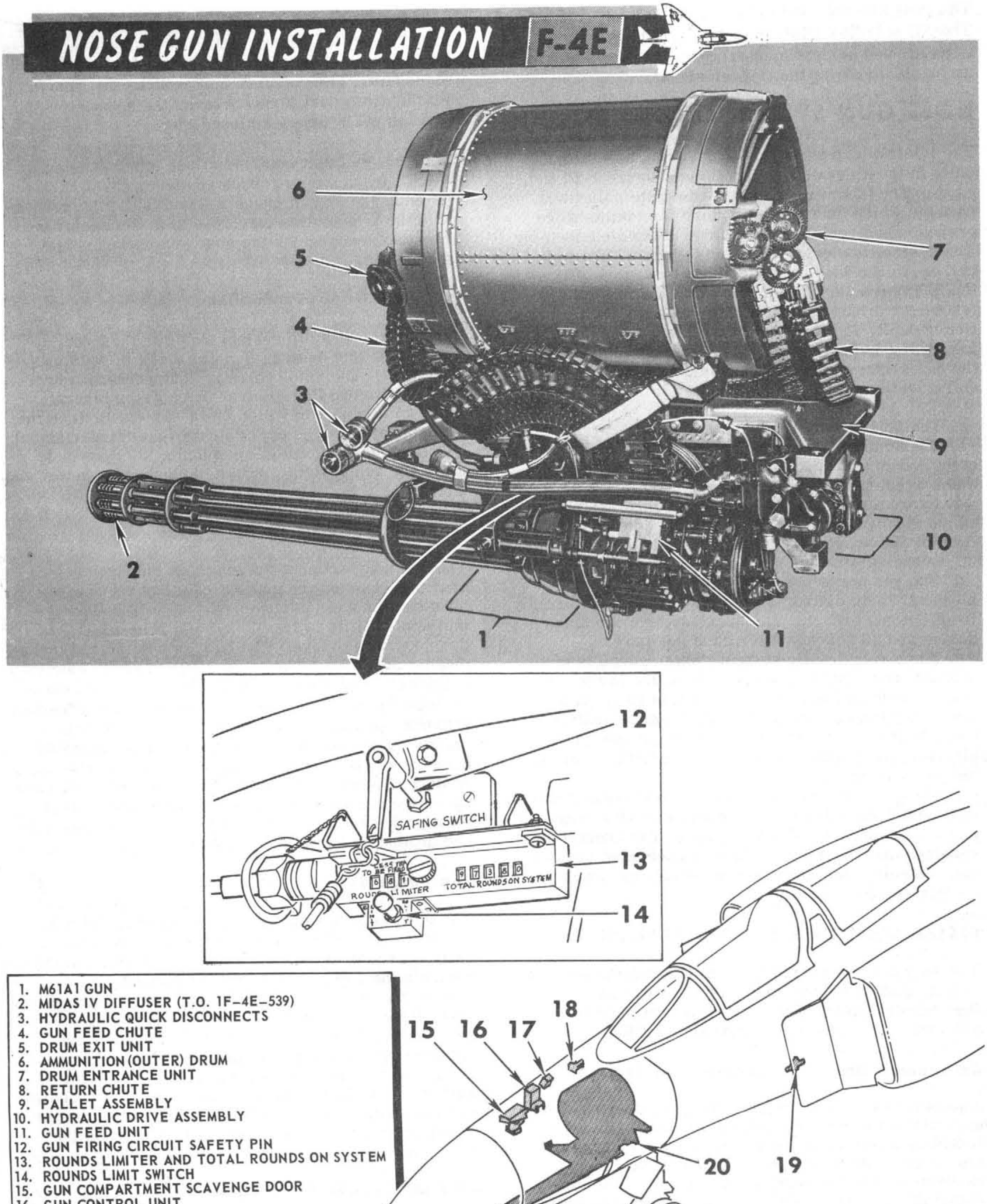
Gun Purge System

The gun purge system operation is coincident with the scavenge system operation above. The electrically operated shutoff valve in this system, however, controls the application of engine bleed (rain removal) air to a jet pump in the gun gas discharge line. If electrical power is lost at the valve, the valve fails in the open (safe) position so that the purge system continues to function. If the AC must dump cockpit pressure for any reason, then purge system air is lost. In such a situation, the scavenge system continues to function and there is no danger of explosion or fire due to gases collecting in the nose gun area.

GUN ELECTRICAL CONTROL

The electrical requirements for gun operation are supplied by the aircraft main bus system and dispersed by the gun control unit. The trigger signal applies voltage to the hydraulic motor solenoid that initiates the hydraulic gun drive force. The trigger

NOSE GUN INSTALLATION F-4E



1. M61A1 GUN
2. MIDAS IV DIFFUSER (T.O. 1F-4E-539)
3. HYDRAULIC QUICK DISCONNECTS
4. GUN FEED CHUTE
5. DRUM EXIT UNIT
6. AMMUNITION (OUTER) DRUM
7. DRUM ENTRANCE UNIT
8. RETURN CHUTE
9. PALLET ASSEMBLY
10. HYDRAULIC DRIVE ASSEMBLY
11. GUN FEED UNIT
12. GUN FIRING CIRCUIT SAFETY PIN
13. ROUNDS LIMITER AND TOTAL ROUNDS ON SYSTEM
14. ROUNDS LIMIT SWITCH
15. GUN COMPARTMENT SCAVENGE DOOR
16. GUN CONTROL UNIT
17. CLEARING SIGNAL UNIT
18. GUN GAS PURGE VALVE
19. HYDRAULIC TWO-LEVEL FLOW VALVE
20. GUN ASSEMBLY INSTALLATION

Figure 1-51

also closes relays in the gun control unit that apply 240 volt dc (rectified 115 volt ac) into the round firing circuit. Other control unit circuits include those that control speed sensing, rounds limiter, and automatic gun clearing.

The gun always operates in an auto-clear mode. (The auto-clear switch on the pedestal has no function in nose gun operations.) During gun firing, the clearing device receives a signal from the speed sensing circuits at a frequency which is directly proportional to the rate of weapon fire. When the AC releases the trigger, the clearing signal device prevents the gun from going into the clearing mode until the firing rate has decelerated below 4000 SPM. Round firing voltage is held on the gun during the clearing cycle so that any rounds chambered before the bolts retract are fired. The delay between trigger release and the point at which all the bolts are cleared is such that approximately 5 to 11 rounds will fire after the trigger is released. (This depends on the initial firing rate.) Further, the time period between the last round fired and complete gun stop results in live rounds (4 to 9) clearing the gun and returning to the drum. The total time period between trigger release and gun full stop is slightly less than one second. During this period, the trigger is disabled and the AC must delay at least this long between bursts.

Rounds Counter

The clearing signal device, which supplies signals proportional to rate of fire, is also used to operate the remote rounds counter on the pedestal panel. The counter system is triggered once for every tenth round cycled through the ammunition feed system.

Rounds Limiter

The rounds limiter device (figure 1-51) on the gun system may be adjusted by armament crew personnel when it is necessary to limit the quantity of rounds to be fired during one flight. The device has a counter unit which is set to actuate a rounds limit switch and stop gun operation after the determined number of rounds have been fired. After T.O. 1F-4E-528 (blocks 31 thru 40), and in block 41 and subsequent aircraft, actuation of the rounds limit switch will deenergize the amber light in the nose station select button.

On modified F-4E aircraft (T.O. 1F-4E-556), actuation of the guns limit switch deenergizes the heads-up GUN light and the nose gun station amber light.

NOSE GUN CONTROLS

Gun Select Controls (Before T.O. 1F-4E-556)

On the pedestal panel, the AC may select the gun weapon system either through the GUNS position on the weapon selector knob, or by selecting GUNS and STORES on the gun toggle switch. In the former case, only gun armament can be fired (nose gun including any gun pods aboard). By using the toggle switch, both the gun firing and conventional bomb release circuits may be activated provided the weapon selector is positioned for other armament. When the weapon selector is used for guns, a reticle alignment signal is directed to the optical sight so that sight A/A operation is not influenced by other weapon controls. With the sight in the A/G mode, however, sight operation is dependent upon the position of the delivery mode selector knob on the main instrument panel.

Guns Missile Switch (After T.O. 1F-4E-556)

The guns select functions are provided by the guns/missiles switch on the left throttle. The rear-most position of the switch selects the nose gun and illuminates the heads-up GUN light. Further gun arm functions are provided by the controls below.

Nose Gun Station Select

Depressing the nose gun station select button eliminates one interlock in the nose gun select circuits and illuminates the green light in the button housing. The amber light in the button, which is a fire ready indicator, will not illuminate until all gun arm interlocks are removed.

Master Arm Switch

Selecting the arm position on the master arm switch energizes all gun select circuits and arms the trigger switch (provided the controls above are energized). Gun firing voltage may now be applied by depressing the trigger. The amber light illuminates to show the ready condition. The amber light is electrically located so that the last rounds switch must be closed for the light to illuminate, and rounds must not be limited. Therefore, the light goes off when all expendable rounds have been fired.

After T.O. 1F-4E-556, the fire-ready indication is provided by the station ARM light and the heads-up ARM and GUN lights. In these aircraft, the GUN and station ARM light also deenergize to indicate the rounds limit or last round circuit activation.

Note

> After T.O. 1F-4E-534, the sight lead compute mode may be operated with the master arm switch in SAFE.

Rate Switch

Once the master arm switch is on, power is available for the rate switch. The rate switch LOW position in turn controls power to the two-speed hydraulic flow valve. In HIGH (which is the OFF position), the valve circuit is open and the gun fires at 6000 SPM. The LOW position (ON) energizes the low flow rate and the gun fires at 4000 SPM.

Trigger Switch

Only the forward trigger switch controls gun firing. The trigger signal energizes a relay in the gun con-

trol unit which completes the round firing circuit. The trigger signal also operates the speed sensing, automatic gun clearing system, and the hydraulic drive solenoids. The gun accelerates to the selected rate of fire in approximately 0.5 second.

With the addition of the optical sight camera (T.O. 1F-4E-558), the trigger becomes a double detent switch referenced here as trigger 1 and trigger 2. The trigger 1 position operates the camera without munition expenditure; trigger 2 fires the gun and operates the camera. Refer to Opticle Sight Camera, this part.

OPTICAL SIGHT/GUN FIRING

The nose gun is harmonized with the optical sight for an optimum firing range of 750 yards (2250 feet). During harmonization, the sight is depressed 2.0° from fuselage reference line. Hence, during strafing missions, the AC must place at least 35 mils into the sight depression control, plus any additional correction for factors such as ballistic drop. Refer to the gun firing tables in T.O. 1F-4C-34-1-2. In an air-to-air situation, the sight is operated in the A/A mode to obtain the lead computing optical sight functions. A description of all optical sight operating modes is provided in this section.

GUNS/MISSILE SWITCHING (BEFORE T.O. 1F-4E-556)

To further demonstrate the above controls, suppose the aircrew is initiating an attack using air-to-air missiles. The optical sight is caged at RBL in the A/A missile operating mode. On the pedestal panel, the AC may pre-select master arm and depress the nose gun station select button. In this case, the guns switch must be left off as long as the aircrew intends to fire missiles. (With guns selected and master arm energized, the trigger/missile fire circuits are locked out.) If for any reason, the missile attack is unsuccessful, the AC may immediately place the guns switch on. The trigger circuits transfer from missiles to gun firing and the optical sight automatically enters the lead compute operating mode. The aircrew maintains the original radar lockon and closes with the target.

Once the range has decreased to approximately 2 radar miles or less (12,500 feet), the aircrew has the prerogative of selecting R1 and switching into radar BST mode. This provides the auto-acquisition capability for the AC. Auto-acquisition functions and associated limitations are more adequately described in T.O. 1F-4C-34-1-1A. Actual lead computing functions of the sight are available at a maximum range of 4000 feet. Hence, the AC may hold the cage function (ARR button depressed) to stabilize the reticle until range becomes 4000 feet or less. At 4000 feet, the reticle range bar reaches the 3 o'clock position.

GUNS/MISSILE SWITCHING (AFTER T.O. 1F-4E-556)

With modified F-4E aircraft, the AC may switch from HEAT or RDR missiles to GUNS by moving the guns/missile switch to the aft position. The optical sight also switches from A/A missiles (RBL) to A/A lead compute. Applying the CAGE signal switches the radar to BST mode, range R1 and with auto-acquisition available. With the CAGE signal held, the sight computes for the 1000 ft. fixed range.

WINGSPAN VS. RANGE

In any air-to-air gunnery situation where radar lock-on is not obtainable (range bar not available), the 50 and 25 mil reticle rings may be used as reference in estimating target range. The estimated range is a function of the known wingspan of the target and diametric dimension of the reticle rings. In part 4, a graph of wingspan vs sight dimension (mils diameter) is provided for target ranges of 1000 through 4000 feet, including the gun harmonization range of 2250 feet. The AC will recall that in situations where lockon is not possible, the sight system functions as if range is a continual 1500 feet - regardless of actual range (figure 1-50).

Note

> A description of gun harmonization methods is provided in section IV, Supplementary Data.

DIRECT DELIVERY MODE

When the DIRECT position on the delivery mode selector panel is selected, the bomb button is in direct control of the bomb release relay. The DIRECT position must be used to fire rocket launchers. Depressing the bomb button releases the bombs, fires rockets or launch the air-to-ground missiles from the selected stations. The direct delivery mode requires that the preplanned release parameters for the mission be established and controlled by the aircrew: the WRCS is not used. The air-to-ground mode of the optical sight is used to establish the bomb release point for a given release altitude, release airspeed, and dive angle.

DIVE TOSS BOMBING MODE

The WRCS dive toss bombing mode is a visual delivery mode used to deliver the low drag bombs. Since preplanned release parameters are not required, the target may be approached from any direction, airspeed, and dive angle. The bomb will be automatically released when the bomb trajectory intercepts the target. Figure 1-52 illustrates the various delivery maneuvers that can be used with the dive toss mode: dive-level, dive-glide, or dive-toss. This manual presently contains the data required (drag coefficients) to deliver bombs using the dive-toss bombing mode.

The AN/APQ-120 radar set is operated in the AIR-GRD mode and in the R1 range to provide a drift stabilized, boresighted antenna. The radar supplies slant range information to the WRCS computer and the optical sight. The lead computing optical sight is used to visually establish a radar fix on the target. The sight is operated in the air-to-ground mode to provide roll reticle display and provide a sight reticle which is electrically caged in elevation to the radar boresight line (depressed 35 mils from the fuselage reference line) and drift stabilized in azimuth. The dive toss bombing mode is selected by placing the delivery mode selector knob to DIVE TOSS and positioning the weapon selector knob to BOMBS/RIPPLE, TRIPLE, or SINGLE. The only controls used on the WRCS panel are the drag coefficient control and, if required, the release advance control. Use of the R2 and R3 range is not recommended since the position of the ground return line sometimes causes inadvertent side lobe lockon.

Note

> With the weapon selector knob in any position other than BOMBS, the sight depresses according to any MIL setting causing a gross error unless the MIL setting is zero.

After the target area has been visually identified, the AC begins to dive toward the target. The slant range (roll-in altitude) is normally 20 percent higher than it would be for direct dive delivery mode to allow time for the accomplishment of air-to-ground lockon by the pilot. Target tracking is not required prior to radar lockon, i.e., the objective is to maneuver the aircraft to obtain a strong ground return on the radar scope which the pilot will use to obtain a lockon. The radar range may be greater than the maximum range display capability of the range bar; thus, the maximum length of the range bar will be displayed. Refer to optical sight display.

Observe the range bar for a false tracking indication. If a rapid decrease in range is displayed, the pilot may have locked on a radar side lobe rather than the main radar beam. Immediately request the pilot to break-lock for another attempt if time permits.

Note

> Lockon can be broken after the bomb button is depressed without affecting bombing accuracy.

The AC should strive for a straightline ground track which is projected through the target. The roll tabs on the sight reticle will assist the AC in maintaining a wings-level dive. The bomb button must be depressed (and held depressed until bomb release) when the pipper is on or slowly passing through the target.

Note

- If it is apparent that the drift stabilization portion of the sight is malfunctioning, a delivery can be accomplished with the sight caged and an estimated wind correction offset aimpoint used.

- The bomb button signal may be delivered at maximum slant ranges of 25,000 feet, and at a maximum altitude of approximately 18,000 feet AGL. The profile in figure 4-6 shows expected computer accuracy under these parameters. The profile considers only computer accuracy, and that computer inputs from all other systems are within specified limits.

After the bomb button is depressed, the AC begins the desired delivery maneuver: dive-level, dive-glide, or dive-toss. The vertical needle on the ADI displays deviations from the magnetic heading established at pickle. The dive-toss maneuver consists of a pullup maneuver (at the desired acceleration rate) that is initiated after depressing the bomb button. The climb angle must not be greater than 10° prior to release to ensure the accuracy of the bomb release point. The dive-glide maneuver consists of a shallow dive toward the target until bomb release occurs. For example: If the initial dive angle was 40° when the bomb button was depressed, the dive must be decreased by a minimum of 5° (40° -5° = 35°) for low drag bombs. If the initial dive was 30°, then the dive-glide maneuver must be a 20° dive or (30° -10° = 20°). The dive-level maneuver consists of a level flight approach toward the target until the bomb release occurs. The dive-toss, dive-glide, and the dive-level maneuvers are illustrated in figure 1-52. The WRCS function and requirements are the same as for the dive toss maneuver. The requirements of the dive-glide and dive-level maneuvers are:

a. The bomb button is normally depressed when the aircraft is at a greater slant range from the target than is required for the dive-toss maneuver.

b. The aircraft will maintain wings level flight (after depressing the bomb button) for a longer period than is required for the dive-toss maneuver.

When the AC depresses the bomb button, the position and attitude of the aircraft, with respect to the target, is set into the weapons release computer. The slant range to the target, obtained by the AN/APQ-120 radar, is resolved with inputs from the INS to establish the ground range and altitude above the target. The weapons release computer begins to integrate ground speed and subtract the results from the initial ground range. Vertical velocity is also integrated and the results are subtracted from the initial altitude above target. The weapon release computer continuously monitors the aircraft altitude and ground speed and automatically supplies a release signal when the computed trajectory of the bomb intersects the target.

AIR-TO-GROUND LOCK-ON

The AIR-GRD radar mode is used only for the dive toss and dive laydown bombing modes. The radar AIR-GRD mode establishes the slant range to the target and route this range data to the WRCS. The WRCS then computes the position of the aircraft with respect to the target and automatically releases the bomb when the target is within bombing range.

Prior to the bombing run, the AC selects one of the dive delivery modes on the delivery mode selector panel, selects the A/G optical sight mode, and prepares the pedestal panel for a weapon release. The pilot places the radar power switch to OPR, the radar range switch to R1, and the radar mode switch to AIR-GRD. The radar antenna and the optical sight are now drift stabilized; the optical sight line is parallel with the radar boresight line (the centerline of the radar beam). The B-sweep (and range strobe) is offset from the center of the scope equal to the drift angle.

After the target area has been visually identified, the AC begins to dive toward the target. When the dive angle is established and the range rate is relatively constant, the pilot may begin the air-to-ground lockon procedure. The receiver gain is reduced to eliminate the radar side lobe return, thereby eliminating the altitude line displayed on the B-sweep. The gain should be reduced until the length of the ground return in the B-sweep is as short as possible before the return begins to break up and fade. The fine adjustment knob on the receiver gain control will aid the pilot in this task. The actual length of the return is a function of the antenna graze angle (aircraft dive angle) and the amount of receiver gain. For a 25° dive angle, the main beam clutter band can be reduced to approximately 1/2-mile long. The clutter band is longer for the lower dive angles.

The center of the main beam clutter band displayed on the scope is the point on the ground receiving the highest concentration of energy — the center of the radar beam. This is also the point on the ground seen by the AC through the optical sight pipper position.

Adjust the receiver gain until the smallest amount of clutter is present. The acquisition symbol should be positioned at approximately 4 miles and lockon should not be attempted until the clutter is in this area. Then depress the action switch to Half-Action. The range strobe will then appear between the acquisition symbol if there is no aircraft drift (or next to the acquisition symbol if there is drift). Slant range is supplied to the computer when the range strobe is on the scope. Move the hand control to position the range strobe directly in the center of the main beam clutter band; then depress the action switch to Full-Action to obtain radar lockon. However, prior to lockon the receiver gain must be reduced to eliminate the radar side lobe return or false tracking

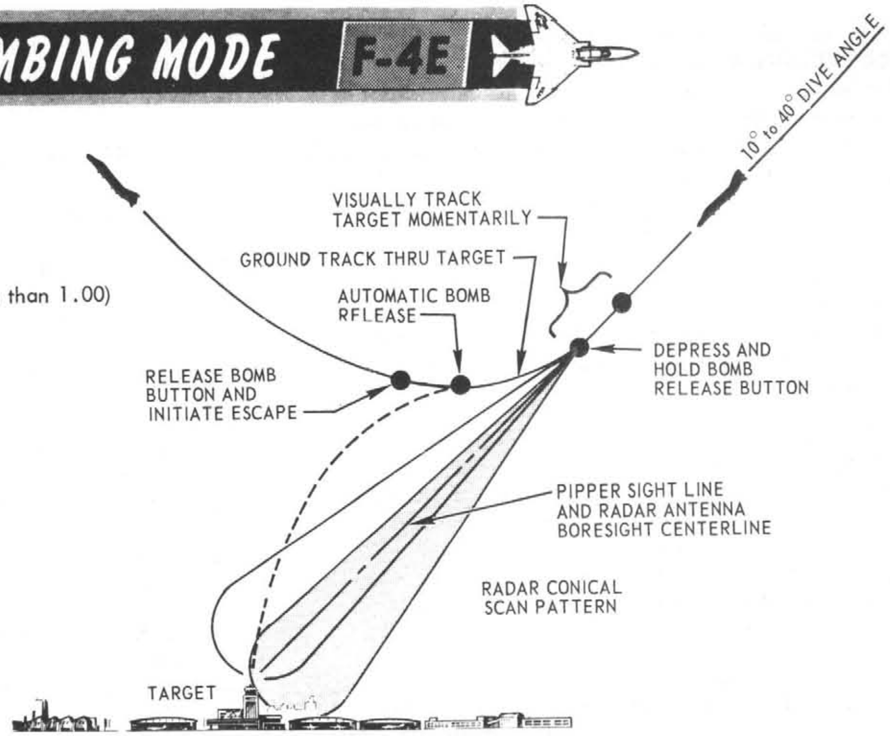
DIVE TOSS BOMBING MODE F-4E

OPTICAL SIGHT:
1. Drift Stabilized
2. Reticle caged to the radar boresight line.

WRCS Manual Inputs:
1. Drag coefficient (not set less than 1.00)
2. Release Advance.

AN/APQ-120 MODE:
1. A/G
2. AI Range

INS Supplies:
1. Groundspeed
2. Pitch Angle
3. Vertical Velocity



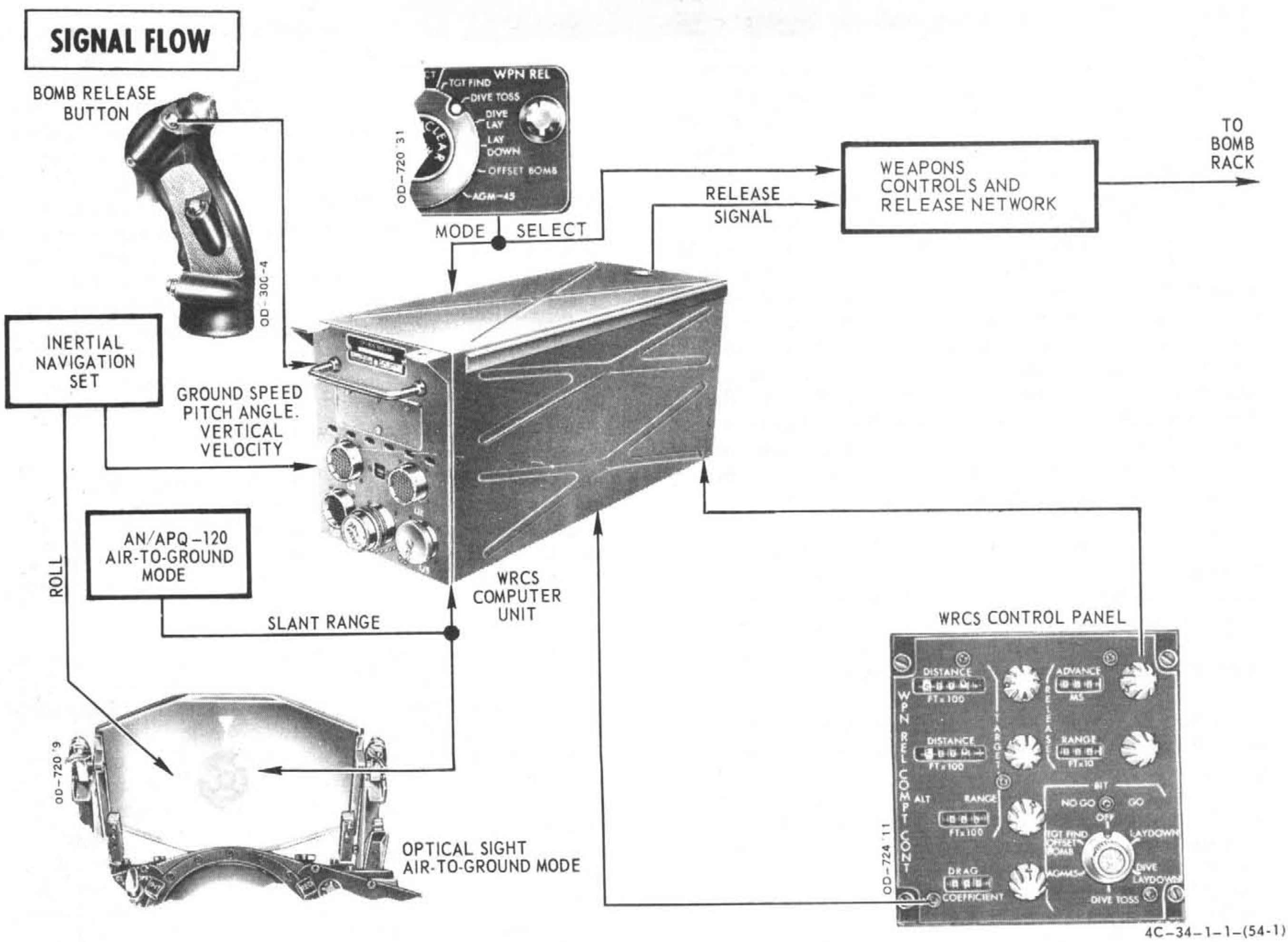
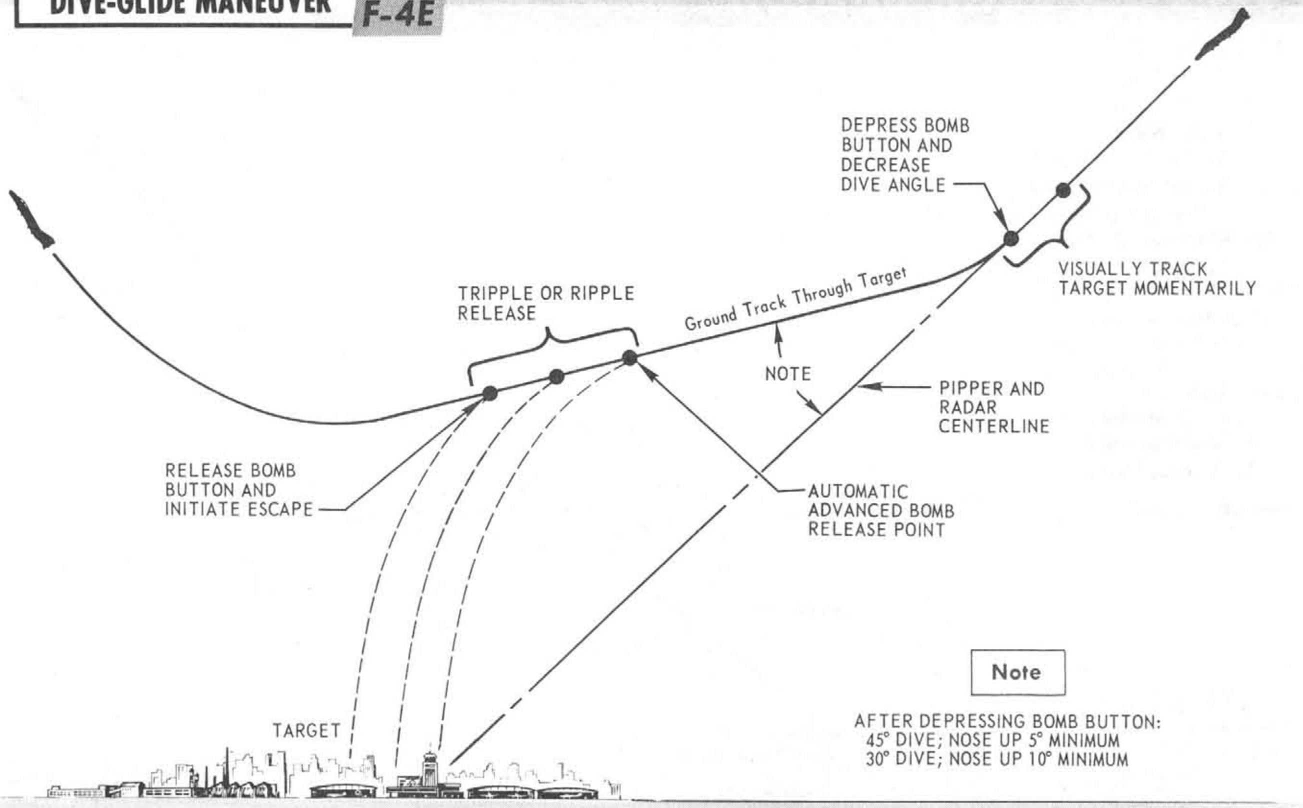


Figure 1-52 (Sheet 1 of 2)

DIVE-GLIDE MANEUVER F-4E



DIVE-LEVEL MANEUVER F-4E

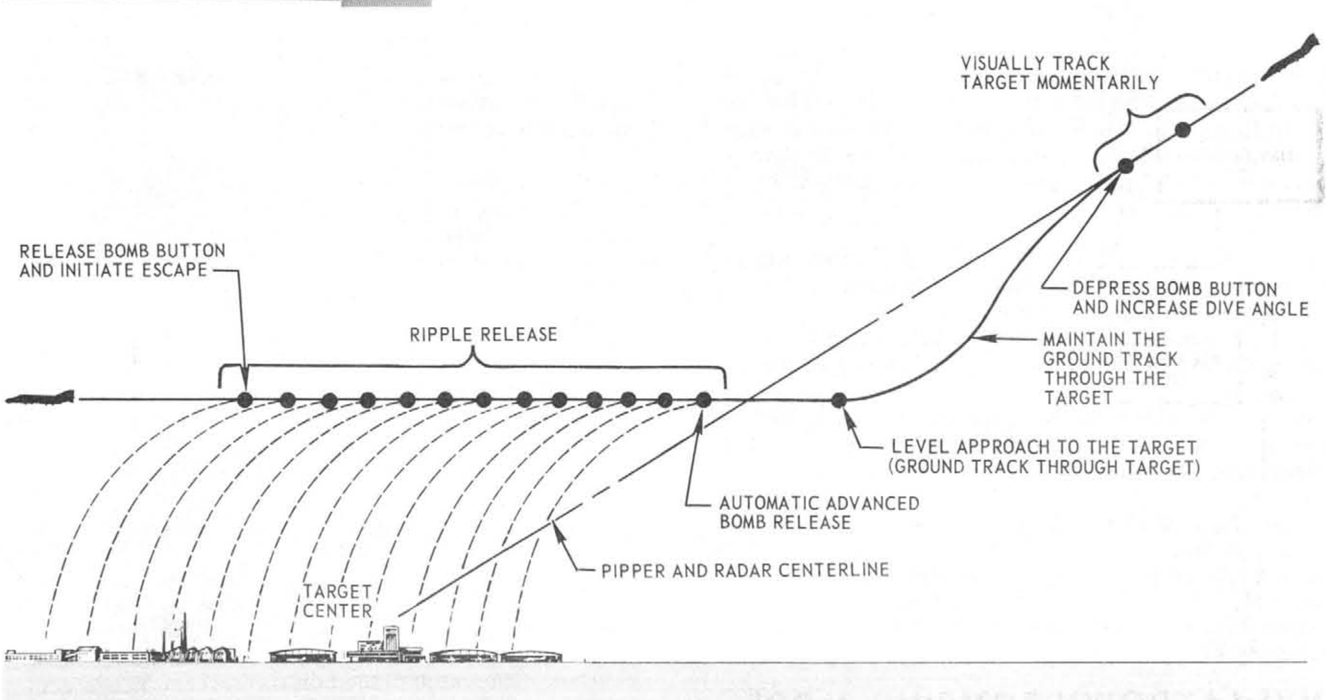


Figure 1-52 (Sheet 2 of 2)

DIVE LAYDOWN BOMBING MODE F-4E

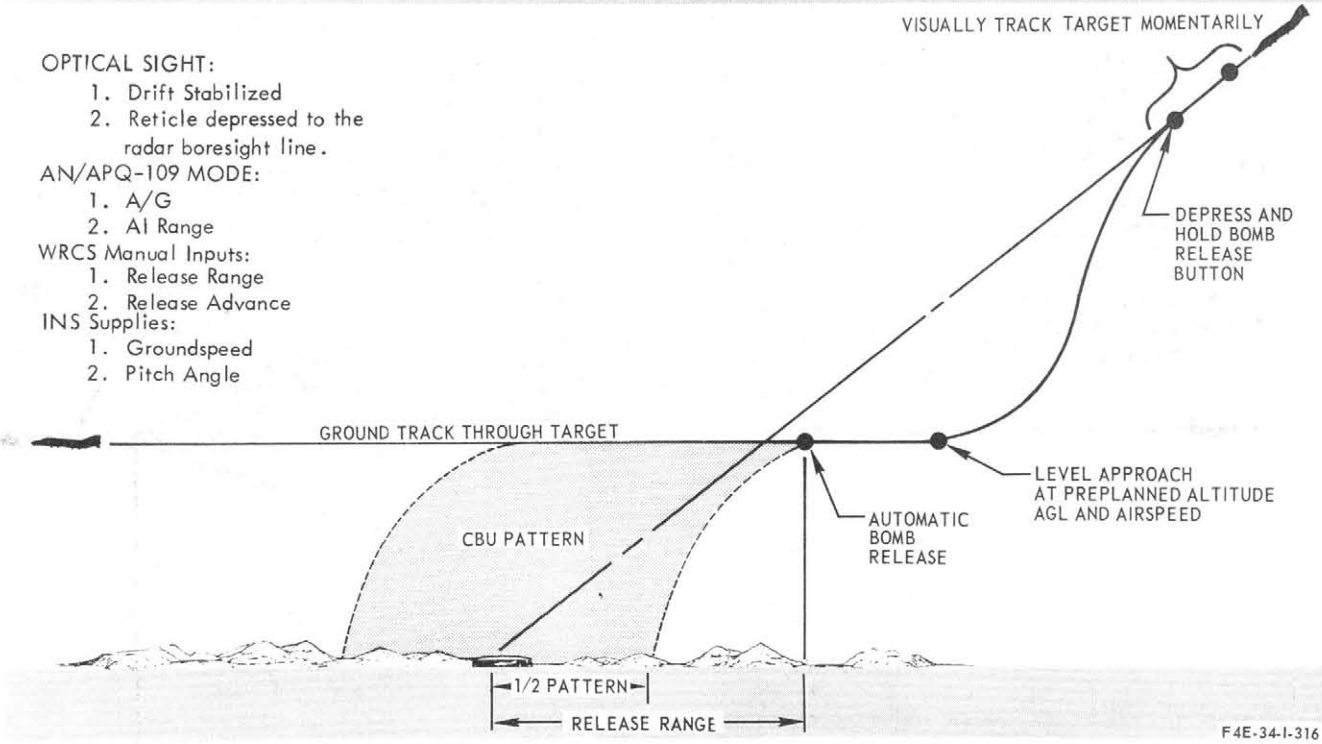


Figure 1-53

could result. False tracking occurs when the radar has locked on the side lobe instead of the mainbeam. When this occurs, the range bar on the optical sight displays a rapid decrease in slant range. If time permits, the following corrective action should be taken immediately:

a. Depress the action switch to Half-Action and release the action switch: lockon is broken.
b. Adjust the receiver gain.
c. Depress the action switch to Half-Action and position the range strobe in the exact center of the ground return.
d. Depress action switch to Full-Action and release the action switch. Confirm the lockon after the ASE circle and Skin Track light is obtained.

Range tracking of the ground return can be rejected by depressing the action switch momentarily to Half-Action. When lockon is broken, the ASE circle and the range strobe is removed from the display, the acquisition symbol reappears and the Skin Track light goes out.

DIVE LAYDOWN BOMBING MODE

The dive laydown bombing mode is illustrated in figure 1-53. The dive laydown bombing mode is essentially the same as the dive toss bombing mode (dive-level maneuver) with the following exceptions for the dive laydown mode:

a. The dive laydown bombing mode is used primarily for the delivery of high drag weapons (CBU-1, CBU-2, Snakeye I, etc.) where bomb range is relatively insensitive to deviations from the preplanned release parameters.
b. The bomb range is manually set in the Release Range control on the WRCS panel; the Drag Coefficient control is not used.
c. The AC must fly the preplanned released true airspeed (or ground speed) and the preplanned release height above target that will produce the bomb range set in the Release Range control.

The dive laydown bombing mode is selected by placing the delivery mode selector knob to DIVE LAY and positioning the weapons selector knob to either RKTS & DISP (for dispensers only) or BOMBS. The only controls used on the WRCS panel are the release range control, and if required, the release advance control. The value placed on the release range control is the horizontal bomb range for a given release altitude above target AGL and release true airspeed obtained from the bombing tables.

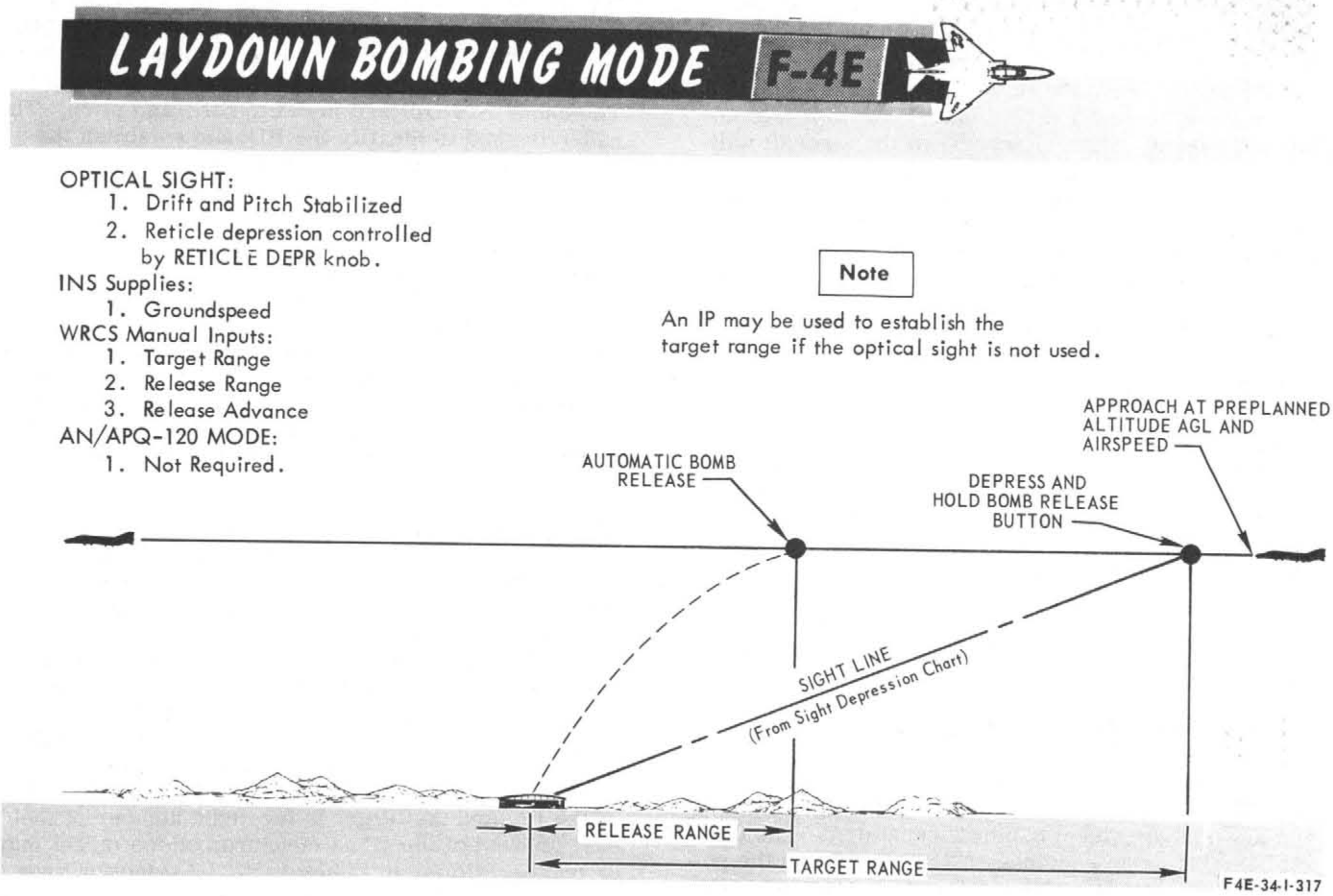


Figure 1-54

The initial portion of the delivery prior to depressing the bomb button is identical to the dive toss-bombing mode, refer to dive toss bombing mode, this section. Depressing the bomb button causes the AN/APQ-120 radar to supply slant range to the WRCS computer and causes the INS to supply ground speed and pitch angle to the WRCS computer. These inputs are used to compute the horizontal distance to the target. The WRCS computer continues to monitor the horizontal range to the target with respect to the initial range established when the bomb button was depressed. When the aircraft is at the release range from the target set in the release range control, the WRCS automatically supplies a release signal to the weapons release circuits.

After the bomb button is depressed, the AC may increase the dive angle to arrive at a preplanned approach altitude AGL. The final approach to the target is made at the preplanned airspeed and altitude above target.

LAYDOWN BOMBING MODE

The laydown bombing mode (figure 1-54) is used for delivery of high drag weapons where the bomb range is relatively insensitive to variations in preplanned release conditions. The maneuver consists of a low level approach and delivery at a preplanned release altitude AGL and at a preplanned airspeed. The AN/APQ-120 radar is not employed by the laydown bombing mode. The lead computing optical sight can be used, or an IP can be used, to establish a known aircraft-to-target distance. The lead computing optical sight is operated in the A/G mode. With the laydown bombing mode selected, the reticle image will be pitch stabilized with reference to the horizontal plane of the inertial platform and drift stabilized along the ground track. The reticle depression is controlled by the reticle depression knob.

During mission planning, a desirable sight depression angle for the planned release altitude is chosen from the sight depression chart; (do not add fuselage angle of attack) the resulting range from the aircraft to target is established and entered in the target range control (placarded ALT RANGE) on the WRCS panel. The horizontal bomb range for the selected release altitude and airspeed is obtained from the bombing table and entered in the release range control on the WRCS panel. For the CBU delivery, or a ripple release, one-half of the pattern length may be added to the value placed in the range control, thereby, placing the center of impact on-target.

The approach to the target is made at the preplanned altitude above target and preplanned true airspeed (or a ground-speed that will produce the established bomb range). When the pipper is on-target, the bomb button is depressed and held until bomb release. When the bomb button is depressed the aircraft will be at the distance from target set in the target range control, the INS begins to supply ground speed data to the weapons release computer, and the ground-speed data is integrated with time by the computer to establish the distance traveled from the point. When the aircraft has traveled the distance entered in the target range control minus the value set in the release range control, a bomb release signal is generated and routed to the release circuit to initiate a bomb release.

The laydown bombing mode is selected by placing the delivery mode selector knob to LAYDOWN and positioning the weapons selector knob on RKTS & DISP or BOMBS. On the WRCS panel, enter the preplanned values in the target range control (the Range light under the ALT RANGE placard will illuminate when LAYDOWN is selected) and the release range control. The release advance control may also be used, if necessary.

OFFSET BOMBING MODE

The offset bombing mode (figure 1-55) provides the aircraft with an all weather (blind bombing), high and low altitude, level bombing capability. The offset bombing mode requires an IP to establish the position of the aircraft with respect to the target. After the aircraft position is supplied to the WRCS computer, steering information is presented to the aircrew. The navigation range from this point to bomb release can be from 500 to 180,000 feet. When the aircraft is at the preset release range from the target, the bomb is automatically released. To provide an IFR capability, either the target or the IP must be radar definable. A radar definable IP is referred to as a radar IP (RIP). To provide a VFR capability, a prominent visual IP (VIP) must be used. The RIP can be beyond the target or offset from the approach course to the target – RIP-flyover is not required. The AN/APQ-120 radar set is not used when a VIP is used; the aircraft must be flown directly over the VIP to establish the aircraft position with respect to the target – the approach can be made from any direction. The final portion of the bombing run prior to bomb release is performed at the preplanned release speed and level approach altitude above target AGL. The release altitude is normally between 50 to 1000 feet; however, the release altitude can be as high as 50,000 feet if the bomb range does not exceed the release range control setting on the WRCS panel (X10 or X100).

The offset bombing mode is selected by placing the delivery mode selector knob to OFFSET BOMB and positioning the weapon selector knob to either BOMBS or RKTS & DISP (for dispensers only). The INS must be in operation for all WRCS modes. The optical sight is operated in the air-to-ground mode, and the AN/APQ-120 radar is operated in the MAP-PPI mode. The optical sight is electrically caged to 0° in azimuth, and to the radar boresight line in elevation. The roll tabs on the optical sight can be used to provide steering information that will guide the AC to the target: the ADI is the primary steering instrument. The radar is stabilized in drift, roll, and pitch. The radar is used to identify the RIP and establish the aircraft position with the aid of the cursor control panel.

After target insert, the drift stabilized MAP-PPI radar display can be used as the primary steering instrument by flying to center the offset cursor on its ZERO azimuth position. Also, after target insert, the radar should be switched to minimum scope range to further increase bombing accuracy. Before using the scope display as the primary steering instrument, the aircrew must establish the ZERO azimuth position of the offset cursor by performing the WRCS BIT check.

The WRCS computer receives manual inputs from the WRCS control panel. The IP pressure altitude (or IP altitude MSL) is placed in the readout control placarded ALT RANGE (the ALT light illuminates when OFFSET BOMB or TGT FIND is selected). The release advance control is set (if required), and the release range of the bomb is set in release range readout control. The position of the target with respect to the IP and the map coordinates is manually inserted in the WRCS control panel. For example, the target is located a number of feet north or south of the IP, and the target is located a number of feet east or west of the IP as measured on the target map or photos. (Refer to figure 1-56, IP selection area.) When the target presents an identifiable radar return and is used as the RIP, the target range readout controls must be set equal to zero, and the target pressure altitude (or target elevation MSL) must be set in the ALT RANGE readout control.

CAUTION

When a value is inserted on the target alt range counter other than 000, do not select the target find or offset bomb mode unless; the aircraft altitude MSL is greater than the value (times 100), or the aircrew is performing the target find/offset bomb BIT check as presented in section II. This is necessary to prevent possible damage to the pitch servo in the WRCS computer.

In situations where the known radar IP is actually higher than the required approach altitude, the aircrew can avoid (through correct planning) any equipment damage mentioned in the caution above. Using the following method, the mission planner determines a reciprocal altitude/range counter setting with respect to the planned approach altitude.

a. Determine the approach altitude above MSL.
b. Determine the difference between approach altitude and the (higher) radar IP altitude (MSL).

c. Subtract the value of step (b) from the approach altitude of step (a); place this amount on the ALT RANGE counter. This establishes an IP altitude and position which is as much below approach as the actual IP altitude is above approach, and the radar range to either point is the same.

d. During the mission, the AC must fly the planned approach altitude during freeze and target insert operations to assure that correct range data is available for the computer.

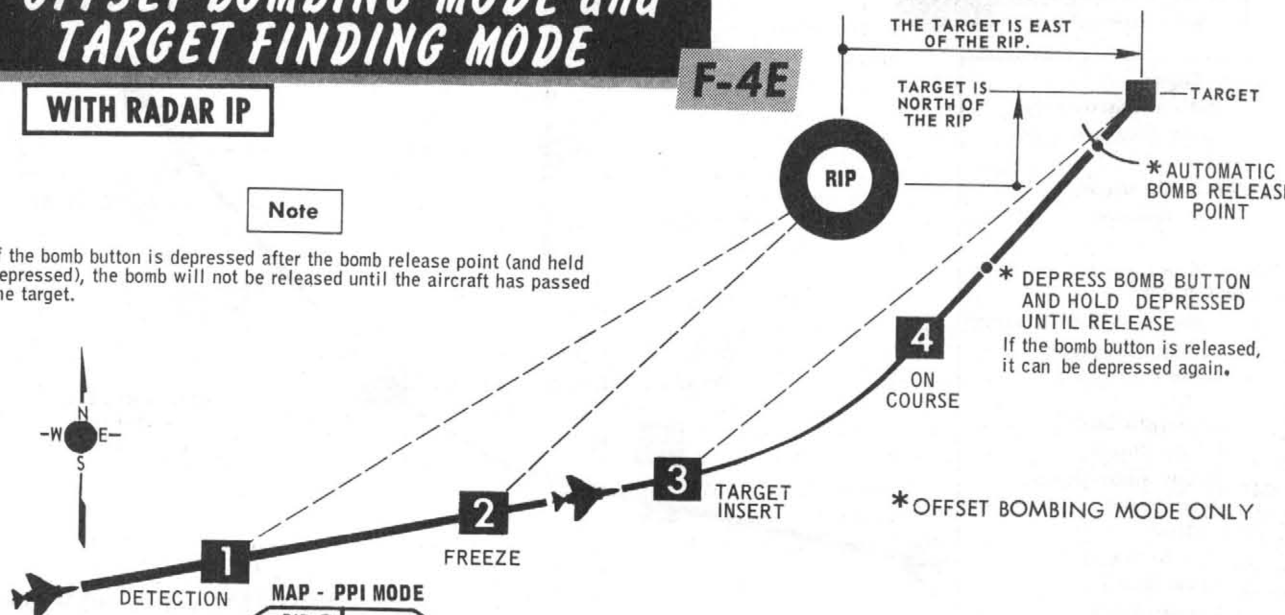
OFFSET BOMBING MODE and TARGET FINDING MODE

WITH RADAR IP

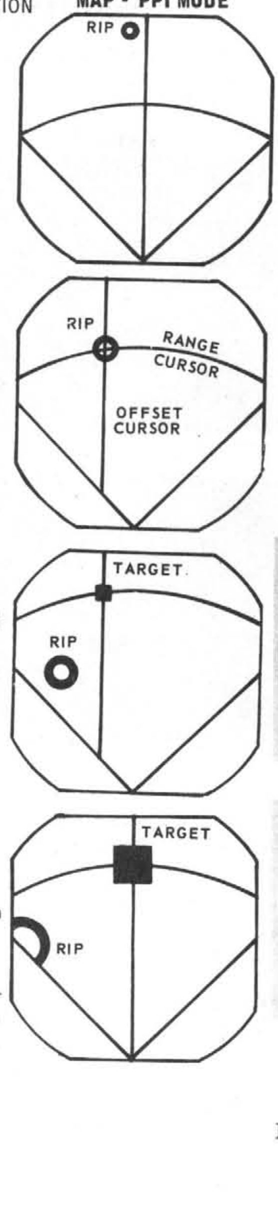
F-4E

Note

If the bomb button is depressed after the bomb release point (and held depressed), the bomb will not be released until the aircraft has passed the target.



MAP - PPI MODE



1 Pilot Detects RIP Return on Radar Scope

2 Pilot Places Cursors Over the RIP and Depresses the Freeze Button.

3 Pilot Depresses Target Insert Button. AC Receives Range and Steering Display and Maneuvers to Target.

4 Maneuver Toward the Indicator and Arrive on Course to the Target. NOTE: The Optical Sight is not Drift Stabilized. PPI display is Drift Stabilized.

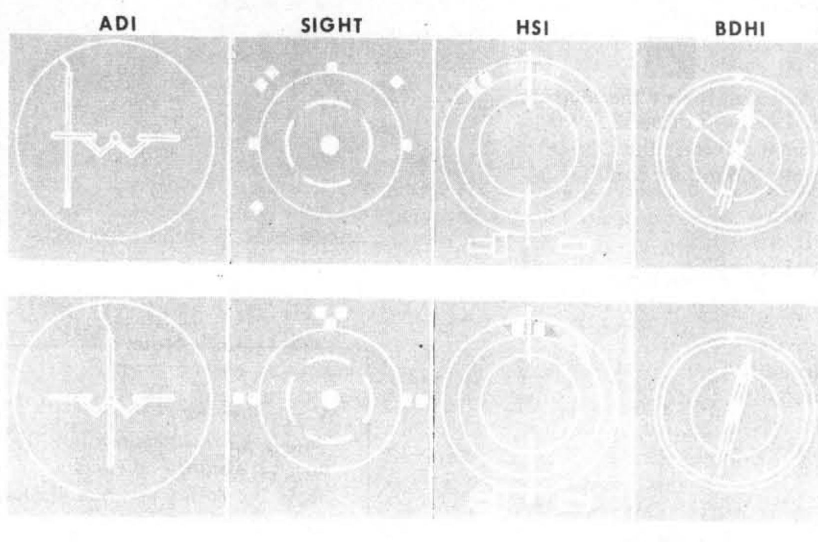
Optical Sight:
1. Caged Zero° Azimuth.
2. Reticle Depressed to the Radar Boresight Line.

AN/APQ-120 Mode:
1. MAP-PPI.
2. AI Range.

WRCS Manual Inputs:
WRCS Panel.
1. Target N-S/E-W Distance.
2. IP Altitude MSL.
3. Release Advance.
4. Release Range.

Cursor Control Panel:
5. Freeze Signal.
6. Target Insert Signal.
7. Cross Track Signal.
8. Along Track Signal.
9. Reset Signal.

INS Supplies:
1. Ground Speed.
2. Altitude MSL.
3. Ground Track.
4. True Heading.
5. Aircraft Velocity East.
6. Aircraft Velocity North.



F4E-34-1-318-1

Figure 1-55 (Sheet 1 of 4)

WITH VISUAL IP F-4E

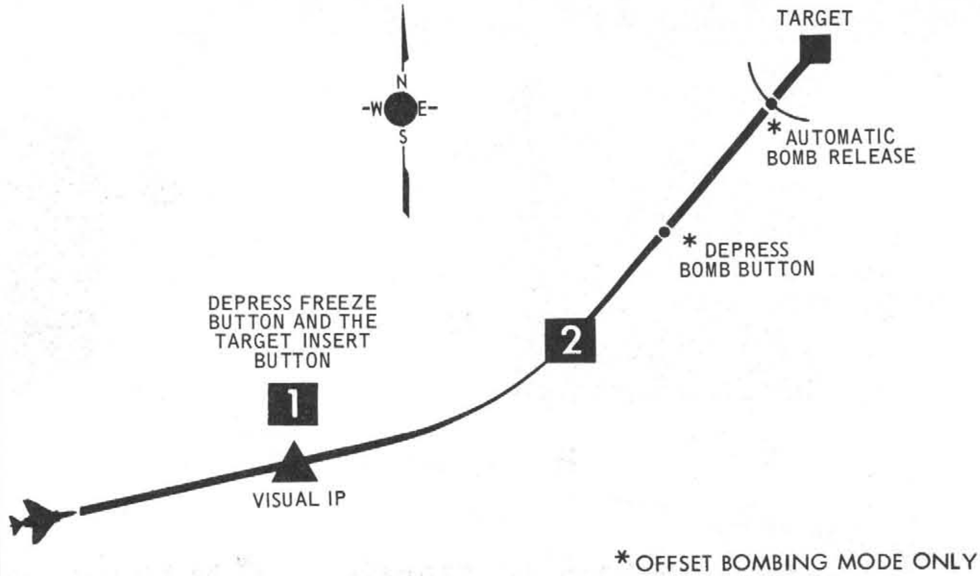
Optical Sight:
1. Reticle caged to the Radar Boresight Line.

AN/APQ-120 Mode:
1. Not Required

WRCS Manual Inputs:
WRCS Panel
1. Target N-S/E-W Distance
2. Release Advance.
3. Release Range.

Cursor Control Panel
4. Freeze Signal.
5. Target Insert Signal.
6. Reset Signal.

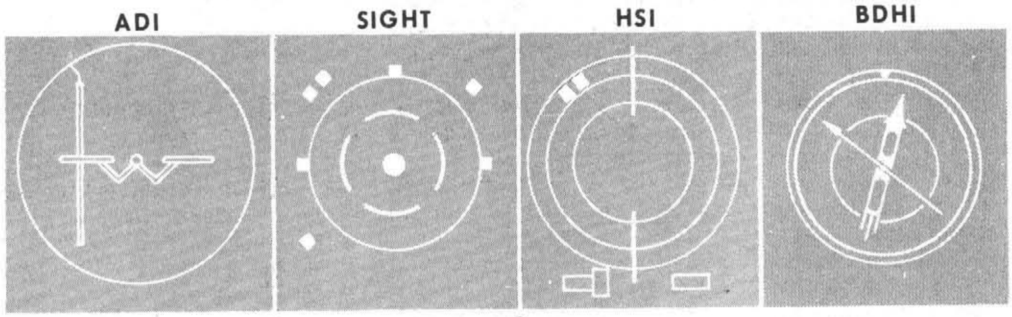
INS Supplies:
1. Ground Speed.
2. Altitude MSL.
3. Ground Track.
4. True Heading.
5. Aircraft Velocity East.
6. Aircraft Velocity North.



ADI | SIGHT | HSI | BDHI

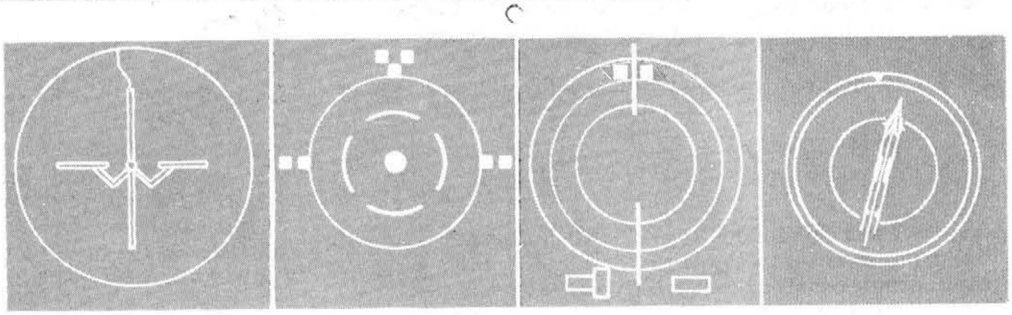
1

Depress the Freeze Button and the Target Insert Button when Aircraft is over IP. Steering Information is Displayed.



2

Maneuver Toward the Indicator and Arrive on Course to the Target. Note: The Optical Sight is not Drift Stabilized.



Note

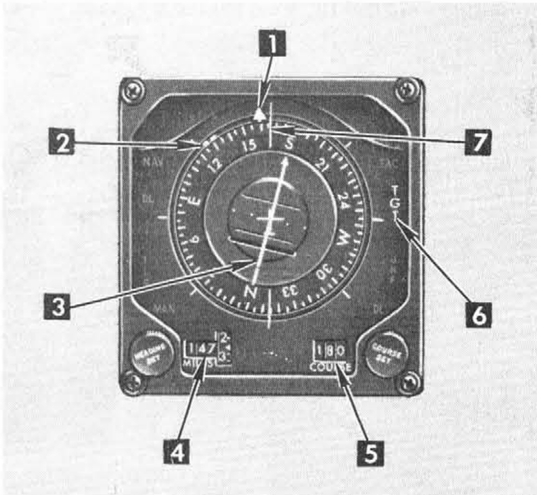
When over the target, the roll tabs rotate and the distance counters begin increasing in value displayed.

F4E-34-1-318-2

Figure 1-55 (Sheet 2 of 4)

HSI INDICATIONS F-4E

FRONT COCKPIT



1 Bearing Pointer: Indicates the magnetic bearing to the target as computed by the WRCS computer and controlled by the NS/EW target distance counter.

2 Heading Marker: Indicates the magnetic heading to the target as computed by the nav computer and controlled by NS/EW target distance counter.

3 Course Arrow: Indicates the magnetic course of the aircraft (ground track), computed by the nav computer; same as Course Window.

4 Range Indicator: Indicates the horizontal distance (not slant range) to the target in nautical miles.

5 Course Window: Same as Course Arrow.

6 TGT Mode Light: Illuminates when the Target Insert button is pushed on (if the instrument lights are ON).

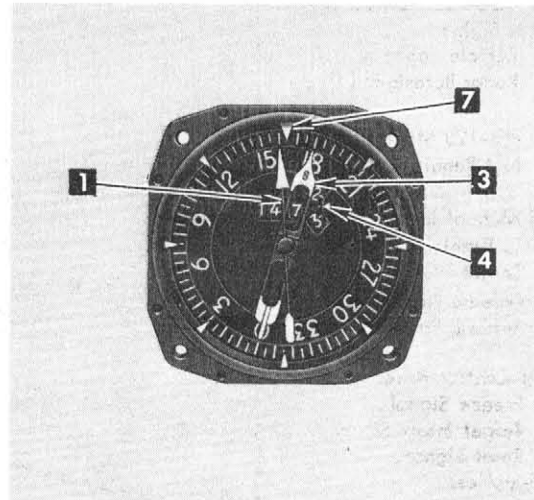
7 Lubber Line: Indicates the magnetic heading of the aircraft.

Note

When the aircraft is on magnetic course to the target, the Bearing Pointer and the Course Arrow are aligned, and the Heading Marker is aligned with the top of the Lubber Line.

BDHI INDICATIONS F-4E

AFT COCKPIT



1 No. 1 Needle: Same as the Bearing Pointer on HSI.

2 NA

3 No. 2 Needle: Same as the Course Arrow on the HSI.

4 Range Indicator: Same as the Range Indicator on the HSI.

5 NA

6 NA

7 Top Index: Same as the top Lubber Line on the HSI.

Note

When the aircraft is on the magnetic course to the target, the No. 1 Needle is aligned with the No. 2 Needle.

F4E-34-1-318-3

Figure 1-55 (Sheet 3 of 4)

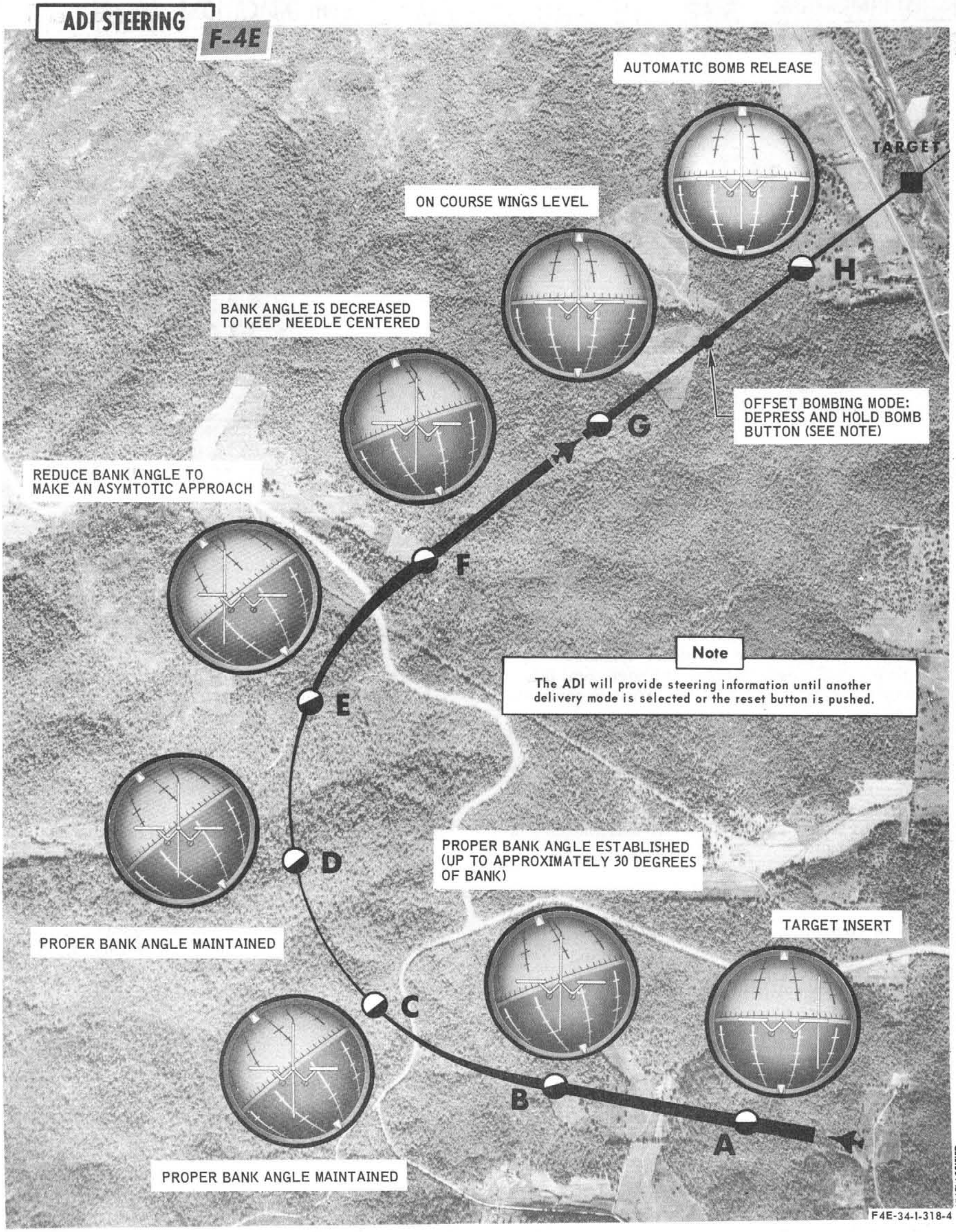


Figure 1-55 (Sheet 4 of 4)

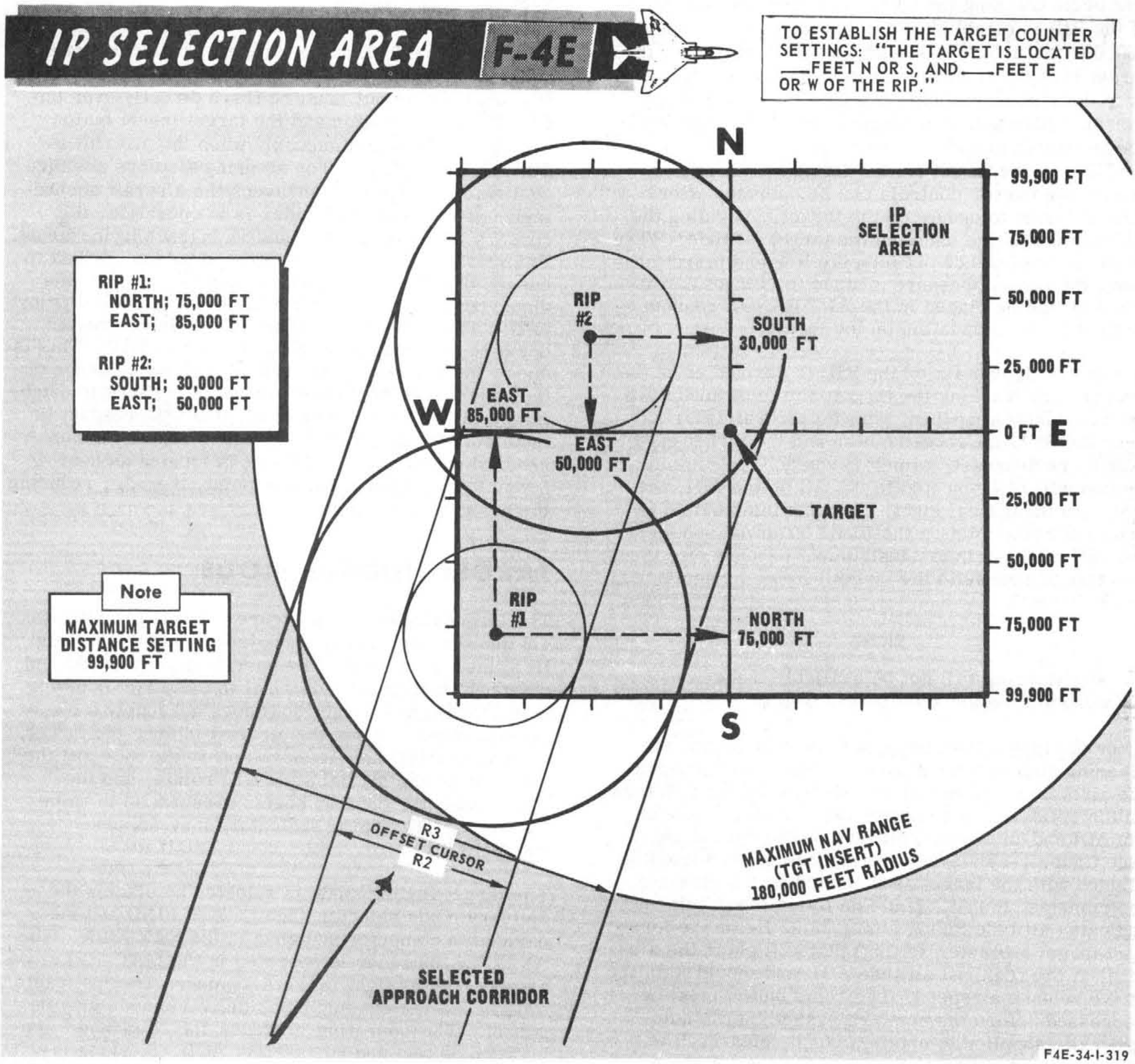


Figure 1-56

The cursor control panel is used to supply inputs to the WRCS computer which establishes the position of the aircraft with respect to the IP or RIP and initiate computer operation. The use of these controls are discussed later. The INS supplies the following aircraft position inputs to the computer:

a. Aircraft ground speed.
b. The velocity vectors: north-south, east-west.
c. Aircraft altitude MSL (standard day).
d. Ground track.
e. Aircraft heading.

The computer uses these signals in conjunction with the MAP-PPI radar and the inputs from the cursor control panel to generate the following displays:

a. The position of the slant range cursor and the offset cursor is displayed on both radar scopes.

b. Horizontal ground range to the target is displayed on the HSI and BDHI instruments if the respective mode selector switches are in NAV COMP.

c. Steering angle of the target is displayed on the HSI, BDHI, ADI instruments, and the optical sight.

d. The bomb release signal is generated and routed to the weapons release circuit to release the bomb.

OFFSET RADAR IP

When using a radar IP, the offset bombing run begins when the RIP is identified on the scope. The pilot positions the range cursor below the RIP return by moving the along-track control on the cursor control panel. The cross-track cursor control is used to position the offset cursor over the RIP radar return. When the RIP return is at the intersection of the cursors, the pilot may push the freeze button: the cursors

now begin tracking the RIP. After positive tracking of the RIP is established and the aircraft is within 180,000 feet from the target, the pilot may push the target insert button; the cursors automatically center over the target and begin tracking the target. The cursor controls can be operated at any time prior to Target Insert to update (touch-up) the position over the RIP. If the target can be defined on the radar scope, the cursor controls can be operated after Target Insert to update on the target, providing the RIP altitude is the same as the target altitude. When there is a difference between the RIP and target altitude, the target pressure altitude (or target elevation MSL) should be placed in the ALT RANGE readout control prior to updating on the target.

If a visual flyover fix on the RIP is desired after the cursors are tracking the target, the pilot must push the reset button and then, when the aircraft is directly over the RIP, the freeze button and the target insert button are depressed simultaneously. Steering information will be presented to the AC on the ADI, the HSI, and the optical sight. Steering information is supplied to the pilot on the BDHI. The AC should use the ADI as the primary instrument to maneuver the aircraft on course to the target. Refer to figure 1-55, sheet 4.

Note

ADI steering will not be available if the weapon selector knob is on AGM-45.

After the target insert button is depressed and the steering displays are available, the AC maneuvers the aircraft in the direction indicated by the roll tabs on the optical sight to center the vertical needle on the ADI and/or center roll tabs on the optical sight (see figure 1-55). When the aircraft ground track is aligned with the target as indicated by the steering instruments, the AC should be flying the preplanned indicated altitude (using either 29.92 Hg or the forecast target altimeter setting) that will place the aircraft at the required altitude AGL and should stabilize at the release airspeed. The bomb button must be depressed before the bomb release signal is automatically supplied to obtain a bomb release. The bomb button can be released and depressed again (prior to bomb release) without aborting the offset bombing run. The WRCS computer supplies the bomb release signal when the distance to the target, minus the bomb release range equals zero. Steering information to the target continues to be supplied. Another bombing run on the same target can be made by flying the steering instruments and depressing the bomb button prior to the bomb release point; however, this method increases the navigation range which will decrease bombing accuracy.

WARNING

If the bomb button is depressed (and held depressed), after the bomb release range is passed, the bomb will not be released until the aircraft has traveled beyond the target a distance equal to the preset bomb range.

VISUAL IP FLY-OVER

When an IP is chosen that will not provide a suitable radar return, the aircrew must visually identify the IP, and the aircraft must be flown directly over the IP. The freeze button and the target insert button are depressed simultaneously when the aircraft is directly over the IP. The steering displays are then available and the AC maneuvers the aircraft accordingly. If the MAP-PPI radar is in operation, the cursors will center over, and begin tracking the target. Prior to the IP, the reset button should be pushed to ensure that the cursors are at zero-zero; and, the along-track, cursor control must not be moved prior to IP. The use of a visual IP will produce greater bombing accuracy than the use of a radar IP. This is due to the inherent radar ranging tolerance error of the radar, and the position error of cursors in establishing the exact location of the RIP with respect to the aircraft. Bombing range error can be further reduced by choosing an IP that is located as near as possible to the bomb release point, thereby, reducing the navigation distance.

TARGET FINDING MODE

The target finding mode (figure 1-55) is provided to aid the aircrew in navigating from a radar or visual IP to the target area. The operating procedures and steering displays are identical to the offset bombing mode; the target-finding mode does not supply a bomb release signal. When the aircraft is over the target, the ADI vertical needle moves off to the side and the roll tabs on the optical sight will rotate, and the range indicator counter begins to increase in value displayed. (The range indicators may not reach 000 MILES.)

The target finding mode is selected by placing the delivery mode selector knob to TGT FIND and the navigation computer switches in the NAV mode. The AN/APQ-109 radar is operated in the MAP-PPI mode and the optical sight in the A/G mode. The applicable switches of the ensuing bomb delivery mode may be preset. The operating altitudes for this mode are between 50 feet and 60,000 feet AGL. Steering information is removed when another delivery mode is selected or the reset button is pushed.

An alternate use of the target-finding mode is as an aid to update the ASN-46 navigation computer set from a radar IP having known coordinates. Set the north/south and east/west target distance counters for a real or imaginary target with reference to the RIP. The target is the location where INS updating will occur. Position the update switch to SET and dial the latitude and longitude coordinates of the real or imaginary target in the navigation computer control panel. The pilot uses the cursor controls to establish a computer fix on the RIP, depresses the freeze button and the target insert button, and the AC maneuvers toward the target. Place and hold the INS update switch in the FIX position. When the BDHI miles-to-go target counter reads zero and the bearing needle swings through 90° to the aircraft heading, release the update switch to the normal position.

Figure 1-57

LABS/WRCS BOMBING MODES

The weapon delivery panel and associated circuits allow the aircrew to energize and use the WRCS target find mode simultaneously with any LABS bombing mode. With the two systems integrated, the WRCS performs navigation to target functions, and the selected LABS mode commands the release signal and delivery flight path. The equipment is provided essentially for the deployment of nuclear weapons. However, the equipment and delivery methods will also apply in certain situations involving non-nuclear weapons. Hence, the following discussion involves no specific bomb, but simply assumes that some bomb(s) - either high or low drag - are aboard the aircraft.

The AC may select any one of six LABS bombing modes (including DIRECT) on the delivery mode selector. Equipment will allow the aircrew to energize and use the WRCS target find functions in conjunction with any of these LABS modes, and most specifically the AN/AJB-7 modes (LADD, LOFT, and O/S). In this case, the WRCS system is being used to deliver an AN/AJB-7 activate signal at the proper range from target and along any ground track projected directly through the target. The following is a general analysis of items that immediately effect aircrew operations.

a. The weapon delivery panel (figure 1-57) is on the rear cockpit right console. The panel includes the activate control switch, the target find switch, and the range switch. These are lock-toggle switches that detent laterally into position.

b. The WRCS system is programmed to provide an extended release range scale to 100,000 feet. This pertains to the (X100) factor selected on the range switch, which applies a multiplier of (X100) to whatever is set in the Release Range (R_R) counter.

OPERATION

In the following discussion, it is assumed that the aircrew is familiar with AN/AJB-7 bombing methods and the WRCS target find mode as they function when individually selected. Also the aircrew must have selected the weapon aboard and performed all pre-arming functions. Assume here that the aircrew intends to plan the LADD/target find bombing mission (figure 1-58).

The aircrew selects TIMED LADD, and energizes the appropriate release and arming switches for the type of weapon aboard. The flight director instruments are placed in the nav. comp. operating mode, and the optical sight is operated in the A/G mode. On the weapon delivery panel (figure 1-57) the pilot must select HOLD on the target find switch; the HOLD position selects the WRCS target find mode of operation.

The WRCS computer control panel is set as it normally would be for offset bomb operations. The only difference is that the release range (R_R) counter must be set with a number representing range from pullup to burst, which is quoted in the appropriate LADD ballistics table. Assume that the ballistics table range (R_B) is quoted at 14,000 feet. This is the range at which the WRCS system delivers a signal activating the LADD system. The aircrew should allow for a small amount of lead-in time at pullup. The lead-in time compensates for any delay in pilot reaction time, and allows time for the AN/AJB-7 to activate into the LADD mode. A feasible lead-in interval is 1 second, which is placed on the pullup timer (T_1 interval). Therefore, the R_R setting on the WRCS control panel is

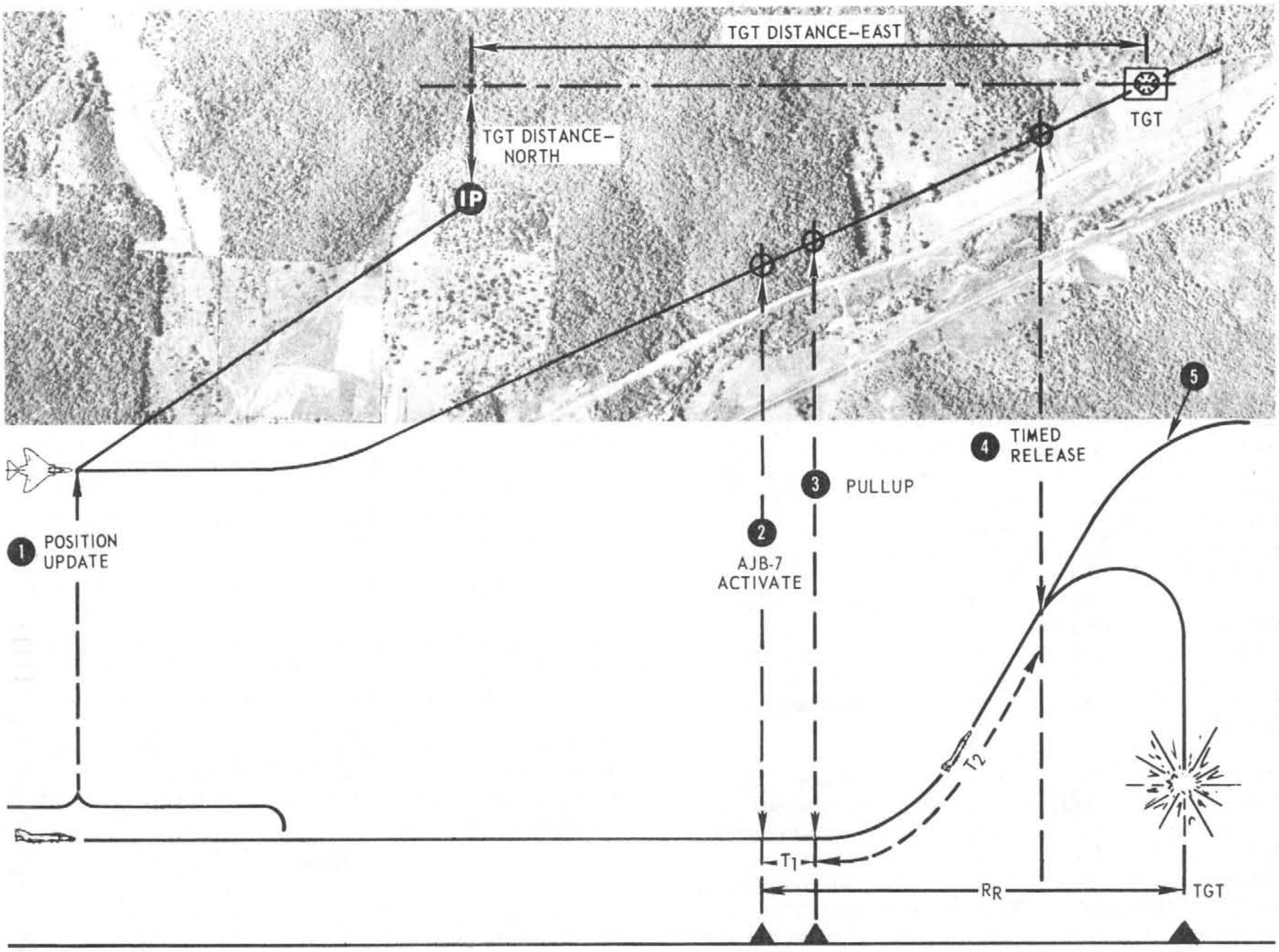
$$R_R = R_B + V_A\,(1.69)\,T_1,$$

where R_B is the bombing table range, V_A is approach velocity in knots, and T_1 is the desired lead-in time. For a 1.0 second T_1 interval and 550 KTAS approach, the R_R setting would be 14,900 feet. In the R_R counter, the pilot would place 149 on the dial and place the range switch to (X100) on the weapon delivery panel. Finally, the pilot sets the T_2 interval on the release timer.

Note

- The selection of 1.0 second for a lead-in interval is only intended as an example here. Whatever the setting is, it should be as small as possible since chances of distance error at the pullup point are increased with longer T_1 intervals. Also, the activate tone is triggered at the activate point, regardless of the value placed on the pullup timer. Hence, the tone may be used both as an activate signal and a pullup warning signal only if the pullup timer is set on a low value. Finally, if T_1 is set to zero, the 0.38 second activate tone occurs directly at the pullup point.
- With the range switch on (X100), the (X10) factor on the release range counter has no meaning. The range switch is also functional in any WRCS modes that require an R_R setting.
- For the WRCS/LABS modes, any release advance (R_A) setting on the WRCS panel advances the activate point by the amount set into the counter. Normally, the counter should be set on zero. However, an R_A setting may be used to apply a tailwind correction or to apply a reaction time correction during the TGT FIND/DIRECT mode.

WRCS/LADD DELIVERY MODE F-4E



1 POSITION UPDATE

1. Pilot positions WRCS cursors over IP and depresses FRZ control.
2. Pilot depresses TGT INS control, steering displayed on HSI, ADI, reticle, and BDHI. AC steers to null azimuth indicators.
3. Pilot selects ACTIVATE <u>after</u> cursors and steering devices complete transition to target.

2 AJB-7 ACTIVATION (R_R)

1. Activate tone sounds (0.38 sec. beep) and T_1 time starts. (T_1 = 1.0 sec. lead-in time.)
2. ADI pointers centered.
3. Pullup light on.
4. AC starts pullup.

Note

- Bomb button signal may be delivered anytime during $T_1 + T_2$.
- All other steering instruments (except ADI) continue WRCS steering.

3 PULLUP

1. AT $T_1 = 0$, pullup light off.
2. Reticle light off.
3. Steady tone on.
4. T_2 time starts.
5. ADI pointers:
   Horizontal - LADD vertical flight path.
   Vertical - yaw/roll error.
6. Bomb button signal must be delivered before $T_2 = 0$.

4 RELEASE

1. AT $T_2 = 0$, release occurs.
2. Pullup and reticle light on.
3. Tone off.
4. ADI vertical pointer out of view.

5 RELEASE BOMB BUTTON

1. Pullup light off.
2. ADI vertical pointer-WRCS steering.
3. ADI Horizontal pointer out of view
4. WRCS steering continues, aircrew may reattack from another direction.

F4E-34-1-321

Figure 1-58

As figure 1-58 indicates, the AC approaches the target area using normal target find (or offset bomb) procedures. The aircrew may select the target as the IP, use an offset IP, or a visual IP fly-over procedure may be used depending on the nature of the target and weather conditions. Once the target insert function is performed, the pilot places the activate switch to ON. Note that if the activate switch is placed ON before target insert, the LADD system could energize prematurely. (At target insert, the WRCS range servos position out to the aircraft range, from target. If the servos pass through the R_R setting, the AN/AJB-7 system could activate at that instant.)

When the aircraft reaches the AN/AJB-7 activation range (14,900 feet in this case), a signal from the WRCS triggers the activate tone and starts the pullup timer (T_1). At this point, the ADI needles switch into the AJB-7 mode, but the remaining steering devices continue indicating target find steering. The activate tone lasts about 1/3 of a second, which means that the AC has about 2/3 of a second remaining to react and begin pullup as the T2 interval (release timer) begins. Notice that the bomb button may be depressed anytime during the (T_1 + T_2) interval; AN/AJB-7 activation occurs automatically and independently of the bomb button when reaching the set R_R range. However, if the pickle signal is delivered before reaching the activation range, the AN/AJB-7 sequence will begin immediately. Also, if the AC inadvertently releases the bomb button during (T_1 +T_2) interval, the signal may be reapplied before T_2 run-out without aborting the run. The lock-out relays are bypassed in the WRCS/AJB-7 modes.

Note

> The 1/3-second activate tone mentioned here is available only in the WRCS/LABS delivery modes. If the AGM-45 is to be delivered using the WRCS/LOFT mode, the activate tone is not available.

The pullup-to-release portion of the LADD maneuver, with which the aircrew is familiar, is flown as figure 1-58 indicates. Aircrews may easily equate the procedures shown in the figure 1-58 to any other LABS maneuver. With a LOFT or O/S mode selected for example, release occurs through the AN/AJB-7 gyro rather than the release timer. The R_R counter is set as a function of the desired pullup distance from target which would be nearly zero in an O/S mode and conceivably as much as 30, 000 feet in a LOFT mode. Also, with the R_R counter set for a known bomb range, the AC can select DIRECT and apply the release signal when the activate tone sounds. In this case, the aircrew has a DIRECT/TGT FIND release mode.

After bomb release, the WRCS target find mode continues to function and the AC may reattack provided that the navigation range of the WRCS is not exceeded (30 nautical miles). If the AC desires, the system is completely recycled by placing the activate switch to NORM and by depressing the reset button on the cursor control panel. The AN/AJB-7 system recycles automatically at bomb release.

WEAPON DELIVERY PANEL

TGT Find Switch

The selective functions of the target find switch and the TGT FIND mode on the delivery selector are identical. If the AC selects a WRCS mode on the delivery selector, the target find switch has no function and should remain in NORM.

The HOLD position energizes the target find circuits along with any LABS mode (including OFF) that the AC selects.

Range Switch

The range switch is functional in any WRCS mode that requires an R_R setting. The (X100) position applies a multiplier of 100 to whatever digit the pilot places in the R_R counter. In NORM, a factor of 10 is applied to the R_R setting.

Activate Switch

Voltage is available for the activate switch as soon as the target insert button is depressed. Placing the activate switch to ON provides continuity to activate circuits in the weapon release computer. These circuits close only when the aircraft range from target becomes equivalent to the set R_R range. This applies the activate signal to the selected LABS circuits and the associated indicators. The pilot must avoid a premature activation by selecting the ON position only after target insert, and only after the range and steering devices have transitioned to the target. If the activate switch is left in NORM, the system is operating in a pure target find mode where any R_R setting has no meaning.

AUX ARMAMENT CONTROL PANEL

Gyro Switch

The AC may fast-erect the AN/AJB-7 gyro platform by selecting the momentary FAST ERECT position on the gyro switch. This applies an electrical cage signal to the gyro caging mechanisms. As the caging signal is applied, the aircraft should be in level, nonaccelerating flight. The switch would have application for example, to correct any noticeable gyro precession during the level, constant speed target run-in.

JETTISON CONTROLS (F-4E) BEFORE T.O. 1F-4E-556

EMERGENCY JETTISON

The inboard and outboard MAU-12 armament pylons cannot be jettisoned. The applicable jettison controls will jettison the MER, TER, or weapon suspended from the armament pylon. The LAU-34/A launcher cannot be jettisoned; the jettison controls jettison the AGM-12B or AGM-45 from the launcher without motor ignition. The AIM-4D launchers are bolted to the inboard armament pylon and cannot be jettisoned; the applicable jettison controls launch the missiles with motor ignition. When the inflight lockout pins are installed, the LO, RI and LI UNLOCKED lights on the DCU-94/A control-monitor illuminate. The RO UNLOCKED light will not illuminate when the lockout pin is installed. (Refer to Jettison Procedures, section III.)

EXTERNAL STORES EMERGENCY RELEASE BUTTON

The external stores emergency release button placarded EXT STORES EMER REL, is a momentary contact, pushbutton switch used to jettison the wing and CL stores (except heat missiles) simultaneously. This control may be referred to as the panic button. The button is in the front cockpit on the left vertical panel. Jettison procedures and the conditions are contained in section III.

SELECTIVE JETTISON

CENTERLINE STATION JETTISON

The centerline station jettison switch (figure 1-59) is a cover-guarded switch on the fuel control panel left console. The switch has two positions: NORM and JETT. The switch is spring-loaded to NORM. Placing the switch to JETT supplies jettison voltage to the centerline station. Refer to section III, jettison procedures.

OUTBOARD WING STATION JETTISON

The wing station jettison switch (figure 1-59) is a cover-guarded, momentary contact switch, spring loaded to NORM. The switch is on the fuel control panel. The switch has two positions: NORM and JETT. Placing the switch to JETT supplies jettison voltage to the left and right outboard wing stations. Refer to section III, jettison procedures.

INBOARD WING STATION (MISSILE JETTISON SELECTOR)

The missile jettison selector knob (figure 1-59) is a rotary type pushbutton switch on the missile status panel. This switch provides selective jettison of the fuselage missiles and inboard wing stations. The switch positions are as follows: OFF, R FWD, R WING, R AFT, L AFT, L WING, and L FWD. Jettison voltage is supplied to the left or right inboard stations by selecting L WING or R WING, and pushing the jettison button. Refer to section III, jettison procedures.

ARMAMENT SAFETY OVERRIDE PANEL

The armament safety override button is a push type switch consisting of a holding coil and three individual double pole switches ganged together by a common plunger shaft and is spring-loaded to OFF. It is above the left console, in the front cockpit, next to the ejection seat. When the override button is depressed, 28v dc is directed to the holding coil from the R 28v dc bus. This holding coil keeps the override button depressed and in doing so directs electrical power from the essential 28v dc bus to emergency jettison circuits and from the R 28v dc bus to the armament bus relay. The jettison circuits are placed in an inflight configuration.

WARNING

With the armament override button depressed, a hazard exists if a centerline station fuel tank is jettisoned on the take-off roll.

LANDING GEAR CONTROL HANDLE

The landing gear control safety switch is an integral part of the landing gear control handle and is used to prevent the inadvertent application of electrical power to the armament and jettison circuits. When the gear handle is UP, this switch directs electrical power from the R 28v dc bus to the No. 1 miscellaneous relay panel, closing the armament bus relay. The armament bus relay then supplies electrical power to the armament circuits. When the gear handle is DOWN, power is directed through the safety switch to the armament safety override button holding coil; thus, the armament safety override button remains pulled in when depressed.

LEFT MAIN GEAR SCISSOR SWITCH

The left main gear scissor switch is mounted on the left main gear strut; it is actuated by a cam on the bottom of the gear scissor hinge. When the strut extends, the scissor links spread and the cam rotates against the scissor switch, depressing the plunger. The scissor switch makes contact when the plunger is depressed. This provides essential 28v dc bus power to the external stores jettison switch, centerline tank jettison switch, and the nuclear weapons jettison switch. The armament safety override button bypasses the gear scissor switch and supplies electrical power to the jettison and release circuits for ground operation.

NUCLEAR STORES RELEASE AND JETTISON

Most equipment suspended from both inboard armament pylons, the left outboard armament pylon and the Aero 27A centerline bomb rack can be jettisoned through the nuclear store release circuit, DIRECT

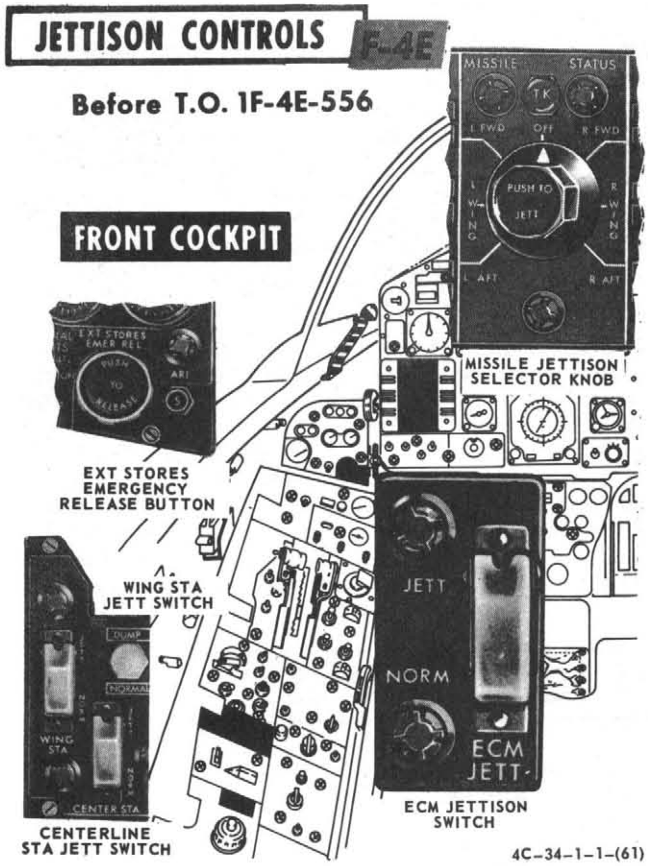


Figure 1-59

release mode. This is accomplished through the DCU-94/A control monitor and the bomb button. Refer to section III for procedures. The nuclear release circuit (DIRECT mode) will not jettison the left outboard MER when the MER is shifted aft. The nuclear jettison circuit (NUCLEAR PUSH TO JETT) will jettison a left, aft-shifted outboard MER. However, the right outboard station could also jettison even though only the left outboard station is selected on the DCU-94/A.

CAUTION

The nuclear store jettison circuit should not be used for selective jettison from a particular station. The nuclear store jettison button (NUCLEAR PUSH TO JETT) should be used as a last resort, and only when the inadvertent jettison from unselected stations is of little concern. For example, the fuselage missiles may jettison and both inboard stations may jettison even though only the right or left inboard station is selected on the DCU-94/A. Both outboard stations may jettison even though only the left outboard station is selected on the DCU-94/A. When only the centerline station is selected, only the centerline station is jettisoned.

ECM POD JETTISON (STATION 9)

On retrofit and production F-4E aircraft, an ECM jettison switch (figure 1-59) provides the ECM pod jettison capability. The two-position cover guarded switch is placarded JETT and NORM. The ECM pod may be jettisoned independently from station 9 (other armament retained) by placing the switch to JETT. Also, the wing station jettison switch may be used to jettison stores from the left outboard station without releasing the ECM pod. When armament is carried on stations 1 and 9, the ECM jettison switch is bypassed and the wing station jettison switch will jettison armament from both outboard stations. Inadvertent pod release during ground operation is inhibited by the protective circuits discussed earlier in this text.

MULTI-STATION ECM POD JETTISON

After T.O. 1F-4-821, provisions are added to carry ECM pods on stations 2 and 8. On F-4E-45 and up; and all others after T.O. 1F-4E-531, multi station ECM pod capabilities are added to stations 2, 4, 5, 6 and 8. ECM pods mounted on stations 2, 5, and 8 are jettisoned by following the normal jettison procedures for those stations. Refer to figure 1-59 for switch illustrations. ECM pods on stations 4 and 6 cannot be jettisoned.

Note

ECM pods (except pods on stations 4 and 6) are jettisoned by depressing the external stores emergency release button. However, any decision to jettison ECM pods must be left to the proper command authority.

MISSILE JETTISON

The jettison circuitry within the firing circuit is controlled by the missile jettison knob on the missile status panel. The AC may manually select any one of the fuselage missiles, either inboard wing station, or any fuselage missile station for jettison. Before missiles can be jettisoned, the emergency landing gear handle must be IN and the weight must be off the landing gear or the landing gear handle must be UP. For ground checkout purposes, these interlocks can be bypassed with the armament safety override button.

RADAR MISSILE JETTISON

With the required interlocks removed, the missile jettison knob is pushed to jettison the fuselage stations. The ejectors used to launch the fuselage missiles are activated by jettison voltage and not the fire voltage. These ejectors are gas cartridges which explode to eject the missile downward from the fuselage. The jettison circuitry for the two forward fuselage missiles is interlocked in such a manner that, if the TK light is illuminated, the missiles cannot be jettisoned. The AIM-7 missiles are jettisoned without motor ignition.

Note

After T.O. 1F-4-750, the TK light is on before and after the M118 or MK 84 bomb is released when the centerline single bomb shorting plug is installed. Even though the TK light is on, the tank aboard relay is not energized, permitting the two forward AIM-7 missiles to be monitored, launched and jettisoned.

HEAT MISSILE JETTISON

The jettison knob on the missile status panel allows the pilot to jettison the AIM-4D and AIM-9 missiles. The jettison sequence of the AIM-4D is not the same as the firing sequence: for left wing, L BOTTOM and after 0.2 sec, L INBOARD; for the right wing, R INBOARD and after 0.2 sec, R BOTTOM.

The armament pylon cannot be jettisoned. When the missiles are jettisoned, the rocket motors are ignited and the missiles are fired ballistically (no guidance, no self destruct). The normal preparation of the missiles is not accomplished, therefore, the warhead fuze in the missile is not armed at launch. There is a 0.2-second delay between the two AIM-4D missiles launched on the same station. The flaps must be UP to jettison the AIM-4D or AIM-9 missiles. The AIM-4D and AIM-9 launch and jettison circuit is interlocked with trailing edge flap circuit to prevent interference during launch. The speed brakes may sustain damage if they are extended during missile launch or jettison. The landing gear must be up to jettison the AIM-4D missile. For AIM-9 jettison, the weight must be off the left main landing gear, i.e., the AIM-9 can be jettisoned if the gear is down and the aircraft is in flight. For AIM-4D missiles, the gear up relay is located in the AIM-4D launcher and prevents AIM-4D launch and jettison until the gear is up (left main gear door closed).

JETTISON CONTROLS (F-4E) AFTER T.O. 1F-4E-556

Conventional stores jettison controls for these aircraft are shown in figure 1-59A. The armament safety override button, the forward and rear landing gear handles, the left main gear scissor switch, AIM-4D gear up relay, and the flaps up relay remain as interlocks in the jettison system. Jettison controls located on the fuel control panel, and the ECM jettison control are removed by T.O. 1F-4E-556.

EXTERNAL STORES EMERGENCY RELEASE BUTTON

This control (panic button) will jettison simultaneously the contents of the four (4) wing armament pylons and the CL station rack. (This assumes MAU-12 and BRU-5/A rack cartridges are installed.) Inboard wing mounted (LI, RI) heat missiles will not jettison, and fuselage missiles will not jettison.

SELECTIVE JETTISON KNOB

The selective jettison control provides selective jettisoning of heat and radar missiles, and of wing and centerline mounted stores. Any store (except nuclear) that can be carried on the aircraft may be jettisoned through this control.

Radar Missiles

The procedures for jettisoning radar missiles remain the same. The missiles are individually jettisoned by selecting either L FWD, R FWD, L AFT, or R AFT fuselage stations and actuating the PUSH TO JETT button. Each fuselage missile jettisons without motor ignition. If a fuel tank, or a MER is aboard the CL station, the two forward missiles are locked out of the jettison circuit and the CL TK aboard light is on.

Heat Missiles

Heat missiles are jettisoned by selecting the L WING or R WING (station 2 or 8) position and depressing PUSH TO JETT. Both missiles on that station are launched ballistically with a 0.2-second delay between missiles.

AGM-65 Missiles

The AGM-65 is jettisoned by using the same procedures as those for heat missiles. The difference is that a single missile is jettisoned each time the JETT button is depressed. The LAU-88/A launcher, including any missiles aboard, is jettisoned by using the procedures for wing station stores (below).

Wing And CL Station Jettison

Wing and centerline mounted store jettison circuits are activated by selecting STORES on the jettison knob. The STORES position applies power from the PUSH TO JETT button through the station select buttons, and on to the cartridge fire circuits of the wing and CL stations. Therefore with STORES selected, the AC depresses the required station select button(s) and depresses the PUSH TO JETT button. Any single-carried store or MER/TER equipment with multiple stores are jettisoned. LAU-34/A launcher mounted stores, such as the AGM-45 missile, are ejected with the launcher retained.

SUSPENSION EQUIPMENT (F-4E)

BRU-5/A BOMB RACK (AERO-27/A)

The Aero 27/A bomb rack (figure 1-60 sheet 3) is a self-contained ejector unit mounted within the aircraft at centerline station 5. The Aero-27/A rack has four suspension hooks: two 14 inches apart and two 30 inches apart. The BRU-5/A rack has only 30-inch hooks, and arming solenoids in place of the 14-inch hooks. An ejector piston is in the center of the rack. When a single weapon is carried, operation of the rack hooks and the ejector piston is initiated through the jettison circuit or the nuclear release circuit by igniting two ejector cartridges. Expanding gases from the cartridges cause the rack hooks to open and the ejector piston to push downward on the weapon. The above procedure is essentially the same when the rack is configured to accommodate multiple weapons. However, the forced jettison of a multiple weapons adapter and MER or a gun pod is inhibited by installing a force jettison prevention sleeve and piston in lieu of the ejector mechanism. The force jettison prevention sleeve and piston (painted bright orange for identification), is designed to permit, the gravity freefall jettison only, and does not affect normal fire/release of multiple weapons. With the bomb rack safety pin installed, an electrical safe switch is opened to prevent the cartridges from firing; the pin is removed prior to flight. The MER cannot be suspended from the bomb rack without the centerline bomb rack adapter. The weight of the Aero 27/A bomb rack (51 pounds) is not included in the basic weight of the aircraft and must be included in any gross weight computation. The weight of the BRU-5/A is 45 pounds.

After T.O. 1F-4-750, the two 14-inch suspension hooks are replaced by two arming solenoids. A centerline single bomb shorting plug is installed to permit the release of the MK 84 or M118 GP bomb through the conventional release circuit. Illumination of the TK light reveals the installation of the shorting plug.

Note

> Even though the TK light is on, the tank aboard relay is not energized; therefore, the forward AIM-7 missiles can be monitored, launched, and jettisoned.

After the bomb is released, the amber station select light remains on and the TK light also remains on.

The M118 or MK 84 on centerline can be jettisoned with the external stores jettison button, the centerline tank jettison switch, the nuclear store jettison button, and can be released through the DCU-94/A control monitor.

CENTERLINE BOMB RACK ADAPTER

The centerline bomb rack adapter is attached to the centerline position to accept the MER assembly. The adapter is compatible only at the centerline, and attaches directly to the BRU-5/A bomb rack. The Adapter weighs 55 pounds.

ARMAMENT PYLONS

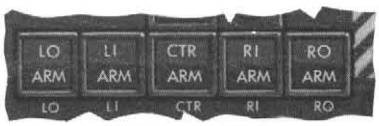
The inboard and outboard armament pylons (figure 1-60 sheets 3 and 4) are bolted to the wing at stations 1, 2, 8, and 9. The pylons cannot be jettisoned. Each armament pylon assembly includes the MAU-12B/A or C/A ejector rack, weapons relay panels, a power rectifier, and bomb release circuits. The ejector rack contains two cartridges breeches and ejector pistons, 14 and 30-inch suspension hooks, three arming wire solenoids, and a solenoid operated assembly that electrically locks (safeties) the cartridge fire circuit. When the cartridges detonate, gas pressure opens the rack hooks and forces the pistons downward, ejecting the bomb. To compensate for various bomb cg locations, orifices are installed into the rack to control bomb separation characteristics by varying the forces delivered to each piston. The ground safety pin provides only a mechanical lock in the hook linkage for ground safety purposes.

The inflight safety lockout solenoid electrically isolates the cartridges by mechanically controlling two switches that break the cartridge circuit. The lock must be removed when the MER or TER is aboard by manually installing the inflight safety lockout pin (or bolt) in the pylon. The bolt is installed only for nonnuclear bomb carriage and must be removed for nuclear carriage. When the bolt is installed, the DCU-94/A UNLOCK light for that station illuminates continuously (except RO station). The arming wire solenoids are controlled by the position of the arm nose tail switch.

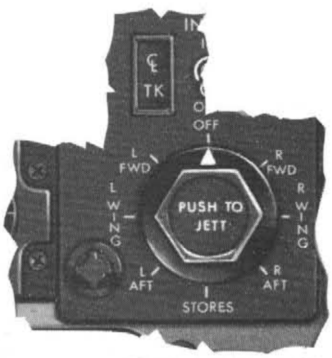
JETTISON CONTROLS F-4E

F-4E After T.O. 1F-4E-556

Selective Stores & Missile Jettison



JETTISON STATION
SELECT BUTTONS



SELECTIVE JETTISON
CONTROL

Multi Station Jettison

EXCLUDING AIR-TO-AIR MISSILES

EXT STORES
EMERGENCY
RELEASE BUTTON

4C-34-1-1-(214)

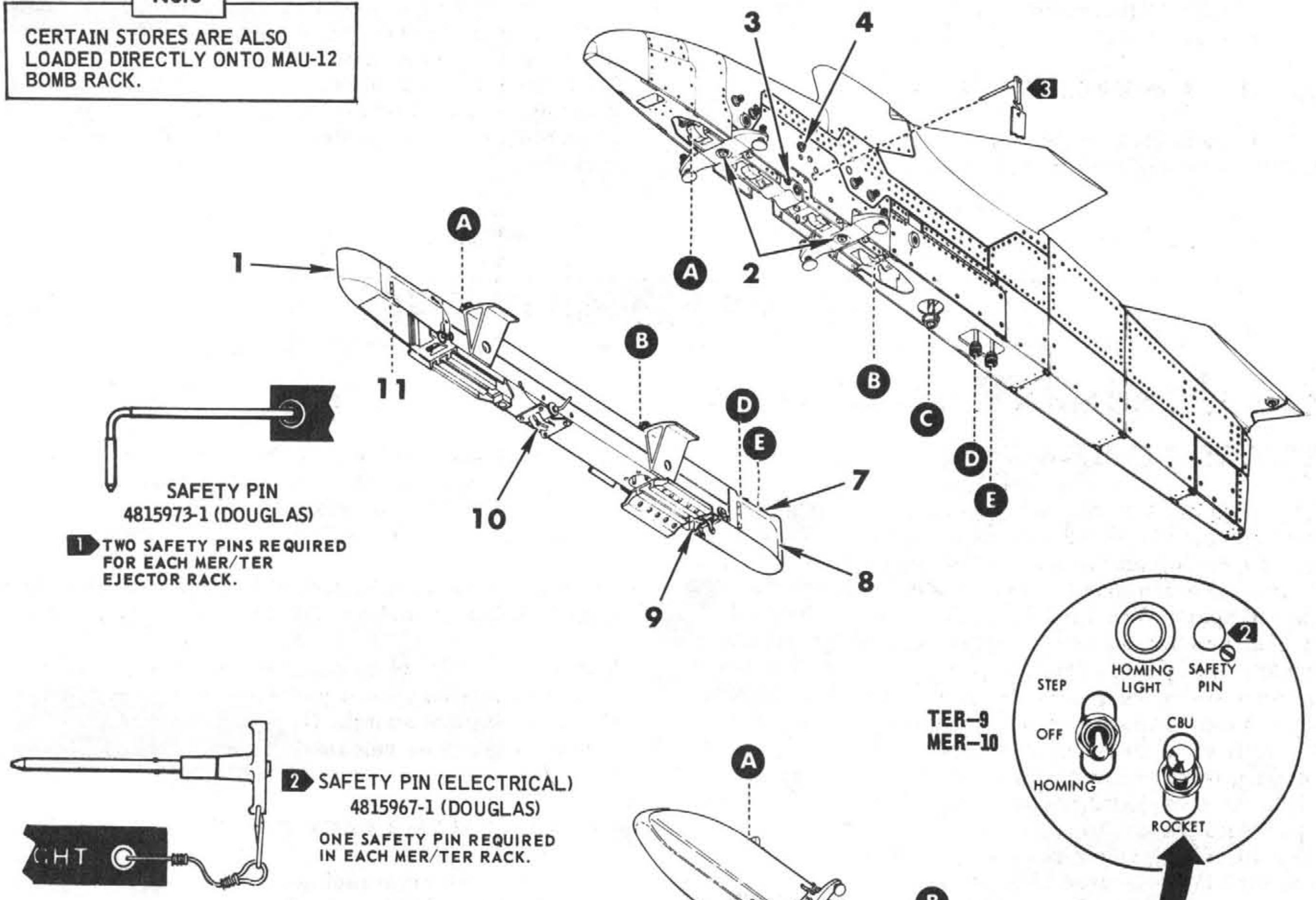
Figure 1-59A

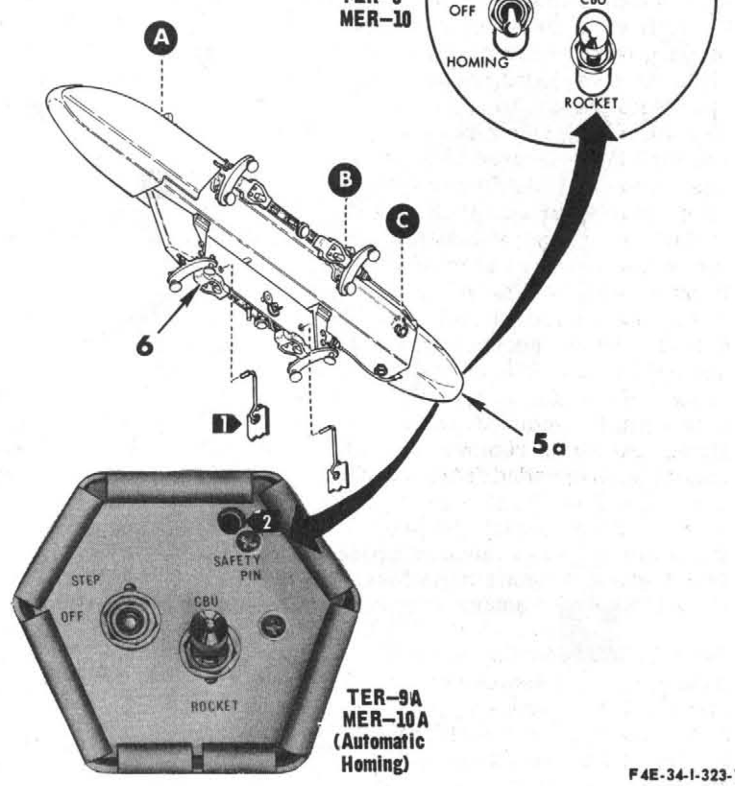
SUSPENSION EQUIPMENT F-4E

INBOARD ARMAMENT PYLON

Note

CERTAIN STORES ARE ALSO LOADED DIRECTLY ONTO MAU-12 BOMB RACK.





1. LAU-34/A MISSILE LAUNCHER
2. EJECTOR RACK PISTON (2)
3. MAU-12 EJECTOR RACK
4. INFLIGHT SAFETY LOCKOUT PIN (BOLT)
5. (a) TRIPLE EJECTOR RACK ASSEMBLY (TER)
   (b) MULTIPLE EJECTOR RACK ASSEMBLY (MER)
6. EJECTOR RACK, MER/TER
7. AGM-12 LAUNCHER BUNDLE (FWD)
   AGM-45 LAUNCHER BUNDLE (AFT)
8. JETTISON GUN ACCESS
9. AFT MISSILE RETAINER
10. FWD MISSILE RETAINER
11. MISSILE/LAUNCHER CONNECTOR

F4E-34-1-323-1

Figure 1-60 (Sheet 1 of 4)

OUTBOARD ARMAMENT PYLON F-4E

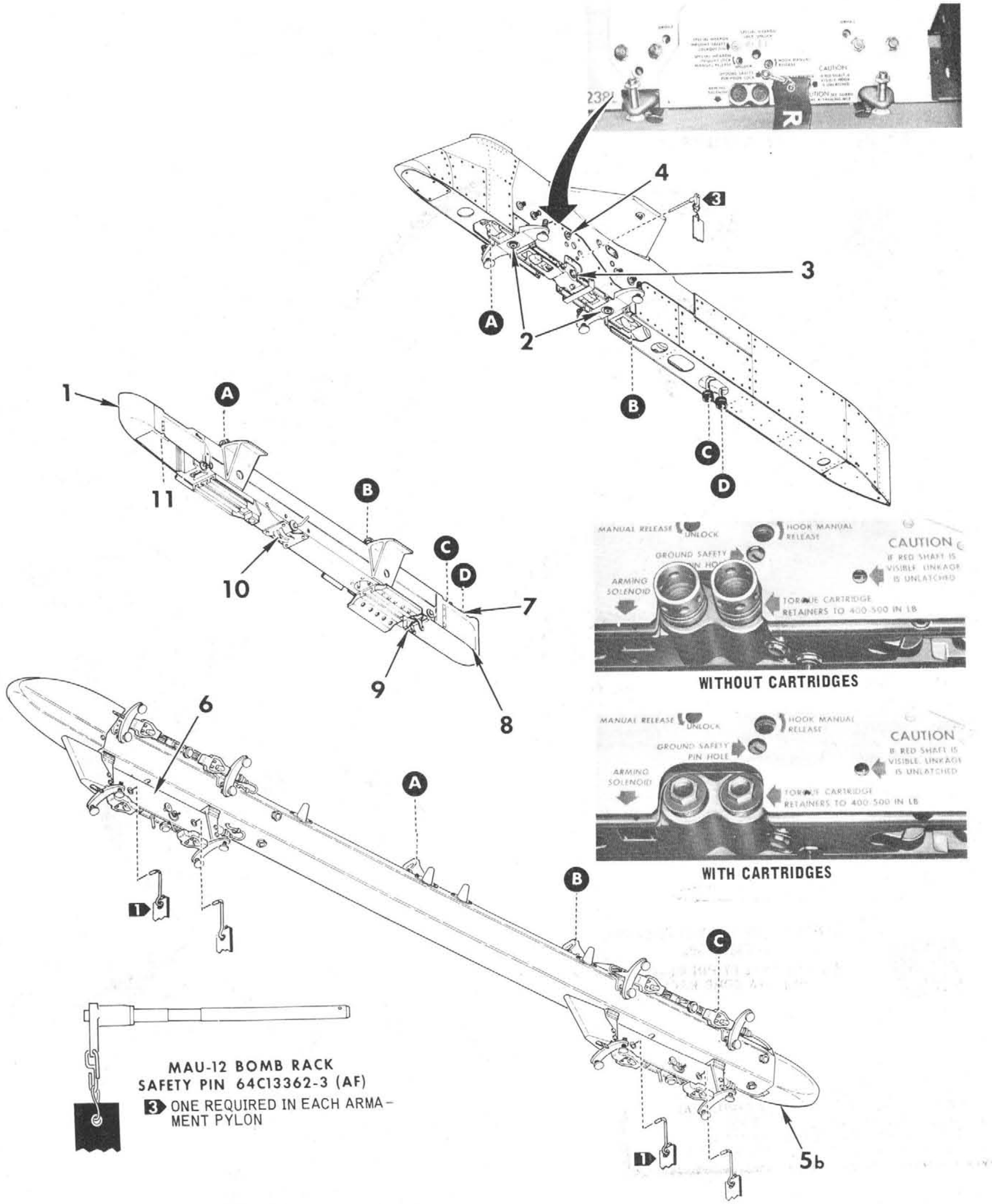
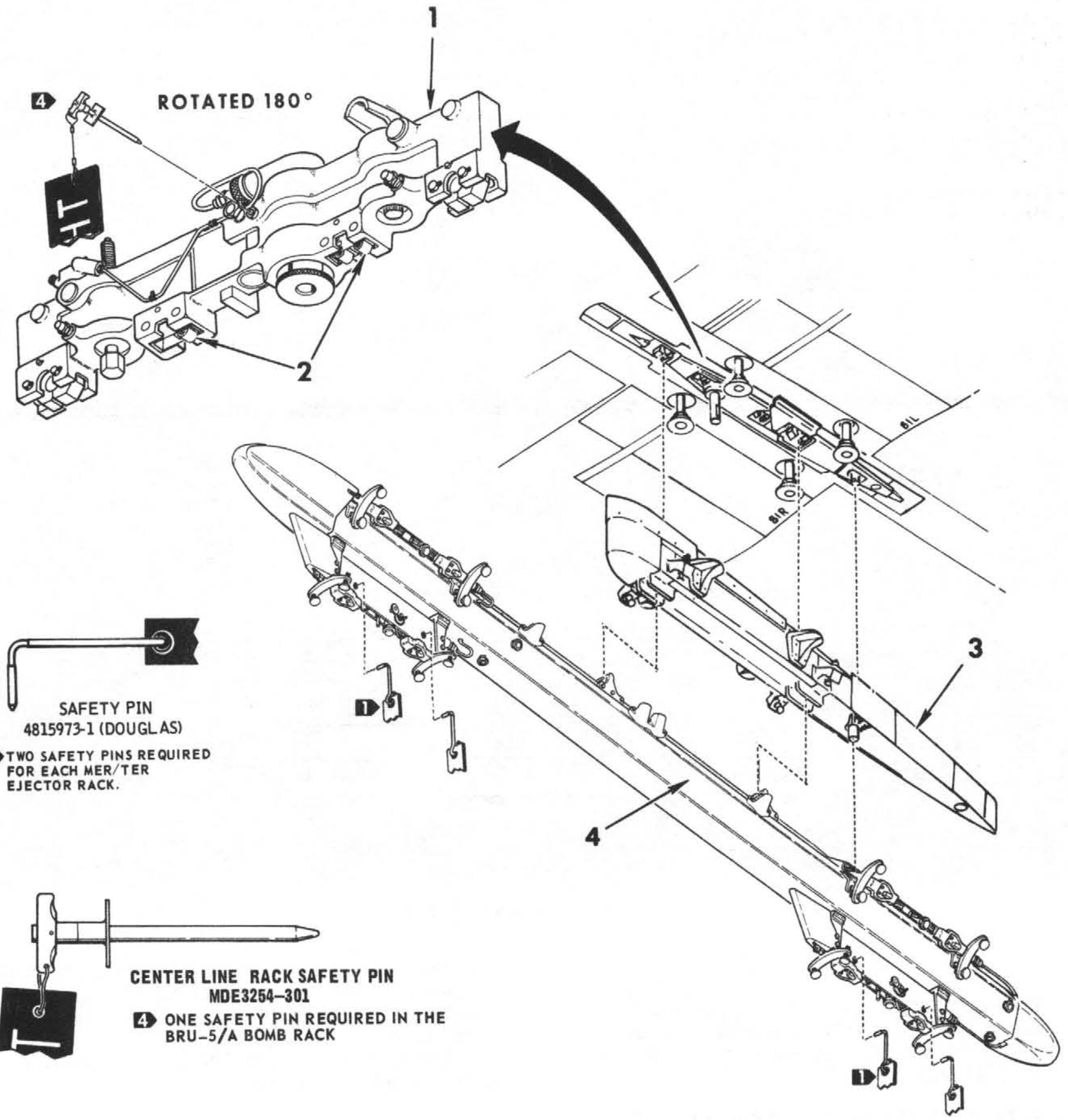


Figure 1-60 (Sheet 2 of 4)

CENTERLINE RACK F-4E



1. CENTERLINE EJECTOR RACK (BRU-5/A)
2. ARMING SOLENOIDS (1 AFT 2 FWD)
3. CENTERLINE BOMB RACK ADAPTER
4. MULTIPLE EJECTOR RACK ASSEMBLY (MER)

F4E-34-1-323-3

Figure 1-60 (Sheet 3 of 4)

SUSPENSION EQUIPMENT F-4E (CONTINUED)

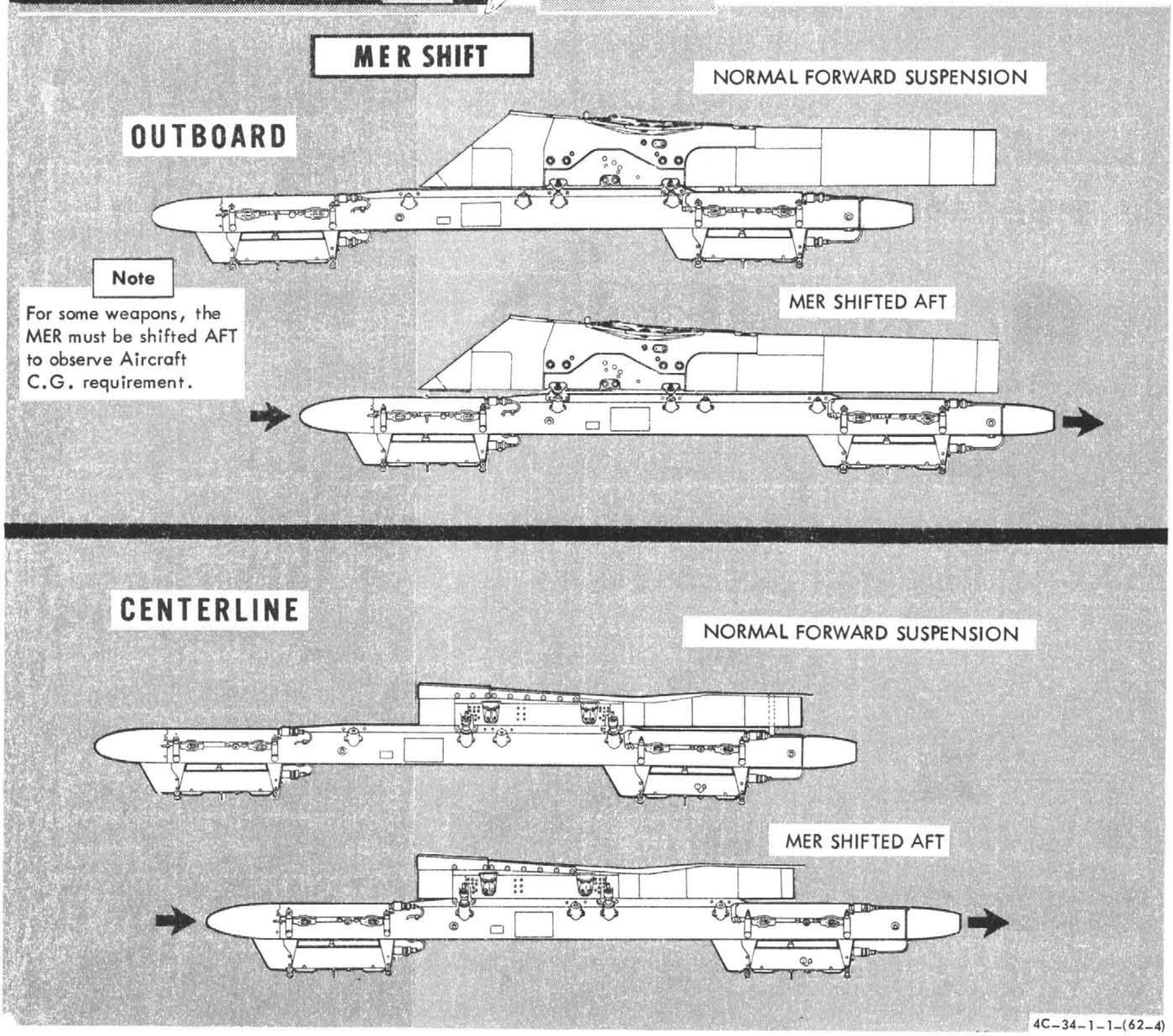


Figure 1-60 (Sheet 4 of 4)

Note

The MAU-12C/A is completely interchangeable with the MAU-12B/A armament bomb rack. The MAU-12C/A is a strenthened MAU-12B/A.

MULTIPLE EJECTOR RACK (MER)

The multiple ejector rack, used at the outboard wing stations and the centerline station are: MER-10, and MER-10A. The MER-10A function differs from the MER-10 as follows:

a. Only the loaded MER-10A stations receive a release pulse regardless of the arm nose tail switch position.

b. The MER-10A is automatically homed to the first loaded station in sequence each time power (28vdc Ess Bus) is applied to the aircraft. The MER-10A does not have a homing light.

c. The Step switch on the MER-10A is used for ground checkout operation.

The MER has two suspension lugs mounted 30 inches apart. The MER consists of six 14-inch ejector units, 12 arming solenoids, the control unit and wire bundles required to arm, and to release and/or fire munitions carried. Each ejector rack or point is identified with a number corresponding to its release sequence. Outboard wing station MER are rigged 1° nose down for rockets. The CL MER is rigged 2-1/2° down for rockets. The centerline MER weight is 215 pounds, the outboard MER weighs 225 pounds.

TRIPLE EJECTOR RACK (TER)

The triple ejector racks used at the inboard wing stations are the TER-9 and TER-9A. The TER-9A function differs from the TER-9 as follows:

a. The TER-9A is automatically homed to the first loaded station in sequence each time power (28v dc Ess Bus) is applied to the aircraft. The TER-9A does not have a homing light.
b. The step switch on the TER-9A is used for ground checkout operation.
c. Only the loaded TER-9A stations receive a release pulse regardless of the arm nose tail switch position.

The TER has two suspension lugs mounted 30 inches apart. It consists of three 14-inch ejector units, six arming solenoids, control unit and wire bundles required to arm, release, and/or fire munitions that are carried. Each ejector rack or point is identified with a number corresponding to its release sequence. TER's are permanently rigged 1° nose down. The TER weighs 95 pounds.

REHOMING MERS AND TERS

A hung bomb can be released, in some cases, after rehoming the MERs and TERs. Rehoming is accomplished in flight by cycling the weapon selector knob from BOMBS to RKTS & DISP and back to BOMBS. This action causes the station stepper switch in all MER/TERs aboard to move from the OFF position to the first loaded station in sequence. The stepper switch will not move if on a loaded station or the MER/TER is empty. (A defective store aboard sensing switch could cause the MER/TER to appear empty.) The MER/TER stepper switch OFF position is obtained only in the BOMBS mode and after a release pulse has been sent to each of the loaded stations on the MER or TER. Additional bomb release pulses will not move the stepper switch from the OFF position. Selecting RKTS & DISP moves the stepper switch from the OFF position because there is no OFF position in the MER/TER with the RKTS & DISP mode. The MER/TER stepper switch always steps to the next loaded station and continues to repeat the cycle when the RKTS & DISP mode is used.

Note

- Do not confuse the *rehoming* procedure performed by the aircrew with the *homing* procedure performed by the load crew. The load crew will position the STEP-OFF-HOMING switch on the MER or TER to HOME and obtain a steady green light. After the load crew has homed the MERs and TERs, the RKTS & DISP position will not move the stepper switch.

- The TER-9A and MER-10A is automatically homed to the first loaded station, in sequence, each time power (28v dc Ess Bus) is applied to the aircraft. The load crew does not home the MER-10A nor TER-9A.

The following causes of bomb release failure can be corrected in flight by rehoming the MER's and TER's provided the MER/TER stepper switch has arrived at the OFF position.

a. Improper homing of the MER's or TER's.
b. Moisture in the bomb ejector rack breech that grounds-out the release signal. After the MER's and TER's are rehomed succeeding release pulses can (in some cases) generate sufficient heat to evaporate the moisture in the bomb ejector rack breech.

The following causes for failure of the bomb release circuit cannot be corrected inflight by rehoming the MER's and TER's.

a. Faulty ejector rack cartridges.
b. Broken or shorted wiring to the ejector rack cartridges.
c. Faulty relays.

If all the bombs carried do not release, the ejector racks should be rehomed and release attempted again. Rehome the MERS and TERS as follows:

a. Weapons selector knob - RKTS & DISP

After the remaining switches are set for bomb release, the bomb button is depressed and held for 4 seconds with BOMBS/RIPPLE selected. With the MER-10/TER-9, if the weapon will not release when the arm nose tail switch is in an armed position, rehome and then repeat the BOMBS/RIPPLE release procedure with the arm nose tail switch in SAFE. If the station loaded sensor switch has failed in the station empty position, releasing the weapons SAFE supplies a release pulse to the loaded stations and the unloaded station.

Note

- The arm nose tail switch position does not affect the operation of the TER-9A, MER-10A stepper switch; the release pulse is directed only to the loaded stations.

- If the bombs cannot be released after performing the preceding procedures, it must be assured that the ejector rack cartridges will not fire, or that MER or TER is malfunctioning.

Consider the situation where three rocket launchers are loaded on a TER. The TER stepper switch is on position No. 1. The TER stepper switch has four positions: 1, 2, 3, and OFF. The first loaded point in sequence is referred to as the home position. Assume that the rocket launchers on points one and two have been fired-out and the rocket launcher on point three is full, i.e., no attempt was made to fire the remaining rocket launcher. (The full launcher must be released or fired before the empty launchers can be released.) To release the rocket launchers, the weapon selector knob is positioned to BOMBS. When the bomb button is depressed, a pulse is supplied to release the full rocket launcher on point No. 3. When the bomb button is released, or the firing pulse is

AERO-7A MISSILE LAUNCHER F-4E

AIM-7 MISSILE

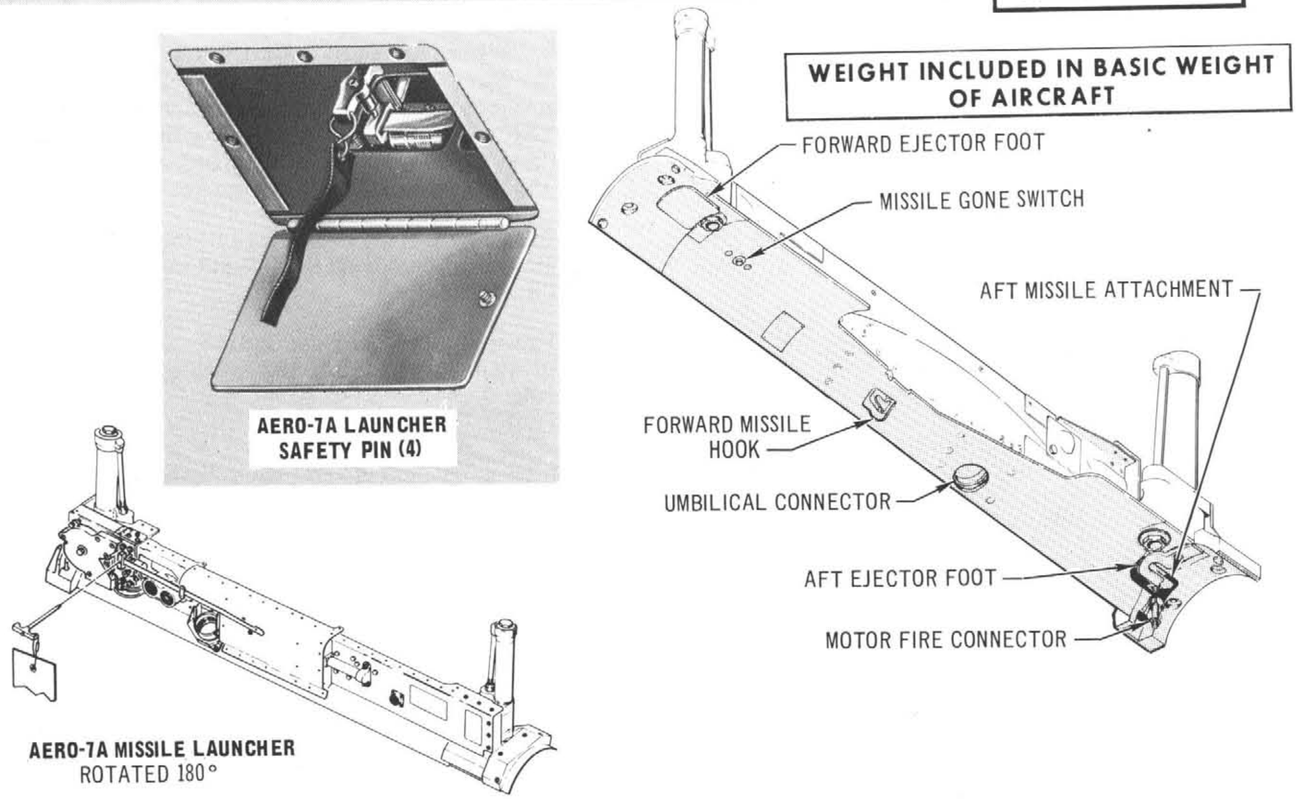
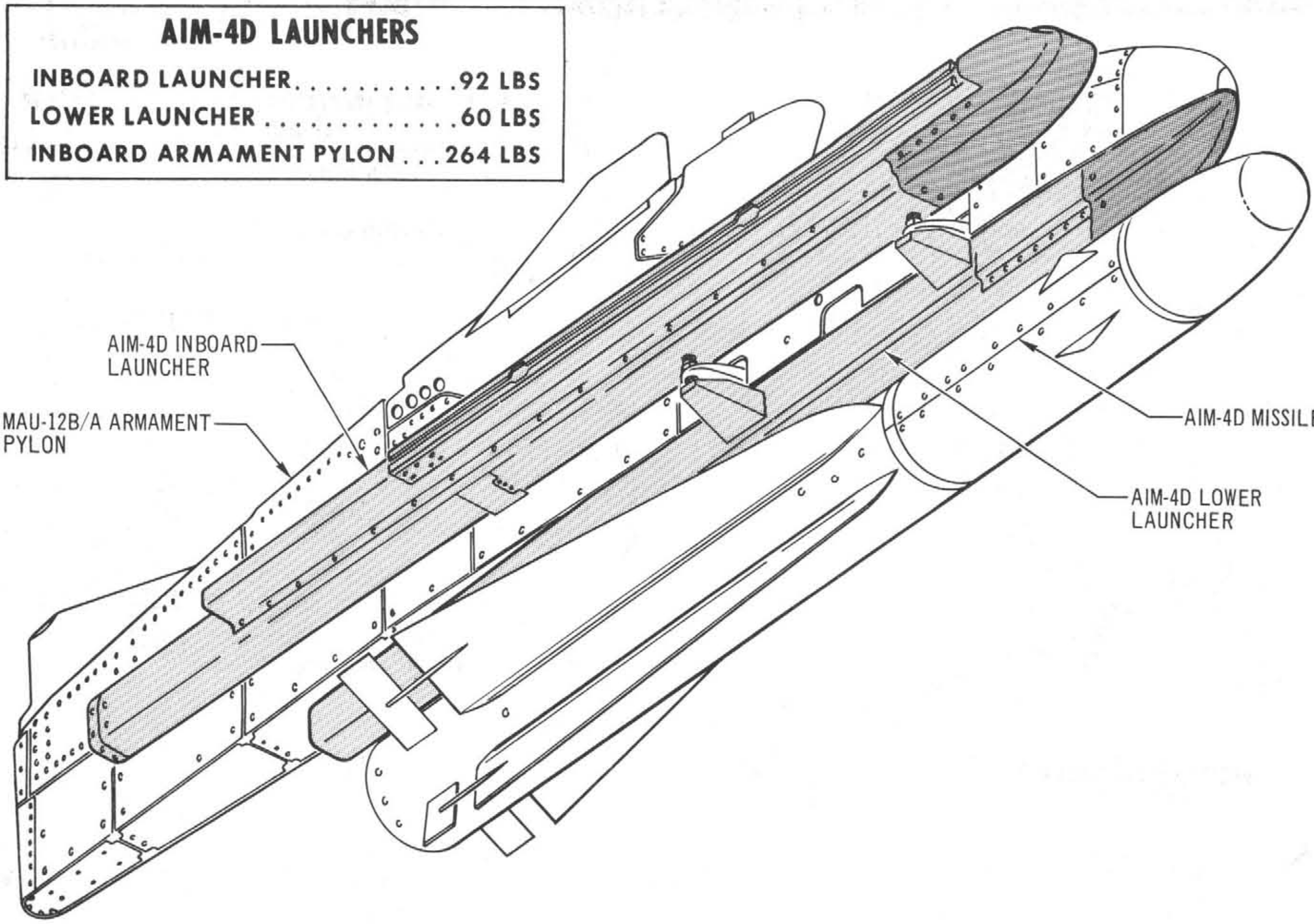
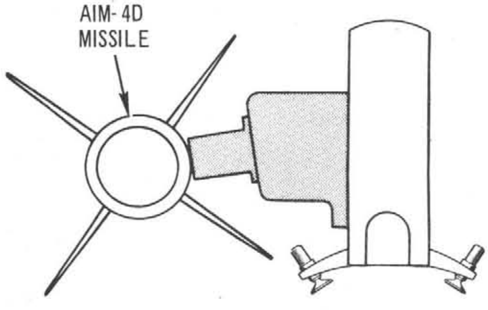


Figure 1-61 (Sheet 1 of 2)

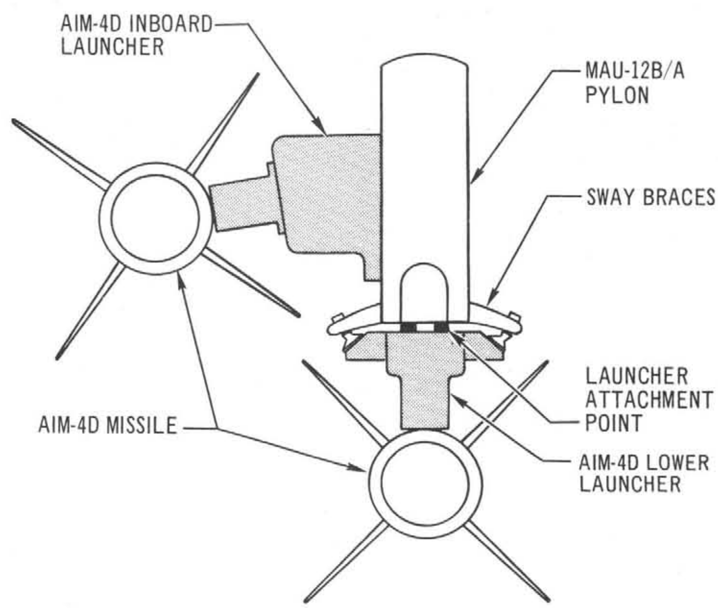
GUIDED MISSILE LAUNCHERS F-4E (CONTINUED)

AIM-4D LAUNCHERS	
INBOARD LAUNCHER	92 LBS
LOWER LAUNCHER	60 LBS
INBOARD ARMAMENT PYLON	264 LBS





STATION 2 (FRONT VIEW)
ALTERNATE LOAD CONFIGURATION



STATION 2 (FRONT VIEW)

F4E-34-I-324-2

Figure 1-61 (Sheet 2 of 2)

All data on page 1-154, Figure 1-62 deleted

ended, the stepper switch moves to OFF. Succeeding pulses will not move stepper switch from OFF. To release the two remaining empty launchers, the weapons selector knob must be positioned to RKTS & DISP. Power is now supplied by the stepper switch to position it to a loaded point; in this case point No. 1. The AC can now select BOMBS and release the two empty dispensers.

In this example, the rocket pods are released from the TER out of normal bomb release sequence, i.e., TER station 3, 1, 2. The normal bomb release sequence is TER station 1, 2, 3 (refer to figure 1-44).

CAUTION

Rocket pods and CBU dispensers (full and empty) should be released from the MER/TER in the normal bomb release sequence to avoid possible aircraft damage.

There is presently no cockpit indication or procedure to ensure which MER/TER station is selected for BOMBS release after RKTS & DISP has been used. The position of the MER/TER stepper switch is established by the number of dispensing signals to the aircraft station and the number of dispensers (or rocket pods) on that station; i.e., the number of dispensing pickle signals to a loaded station must be equal to the number of dispensers loaded on that station (or a multiple of the number of dispensers on that station) prior to selecting BOMBS to release the dispensers/rocket pods from the MER/TER.

The release sequence is more likely to be out of sequence when the outboard, inboard, and centerline aircraft stations are not loaded with the same number of dispensers (or rocket pods) and all aircraft stations are selected for dispensing (RKTS & DISP/SINGLE). For example: assume a configuration of 4 dispensers on each outboard station and 3 dispensers on each inboard station and on the centerline station (17 dispensers total). The inboard and centerline stations should be deactivated after the third dispensing pickle (15 dispensers have been emptied). After the fourth dispensing pickle to the outboard station, reselect the inboard and centerline aircraft stations, select BOMBS/RIPPLE, and hold the bomb button depressed to release the dispensers from the MER/TER in the normal bomb release sequence.

AIR-TO-GROUND MISSILE LAUNCHERS

LAU-34/A LAUNCHER

This assembly must be used to carry and launch the AGM-12B and AGM-45A missiles. The launcher contains the electrical circuits and relays which are responsible for the dispersal of missile pre-heat, pre-arm, and missile launch voltage. The method of carriage is illustrated (figure 1-60). The launcher also contains a cartridge-fired jettison gun assembly. Expanding gas from the detonated cartridges operates the assembly and slides the missile rearward, free of the launcher rails. The missile freefalls in an inert state.

LAU-88/A LAUNCHER

The LAU-88/A launcher assembly is used to carry and launch the AGM-65/A (Maverick) missile. Refer to T.O. 1F-4C-34-1-1A.

AIR-TO-AIR MISSILE LAUNCHERS

AERO-7A LAUNCHER

Four Aero-7A launchers are mounted to the fuselage so that four AIM-7 missiles are semi-submerged. The Aero-7A launcher (figure 1-61, sheet 1) has two ejector pistons which are operated by gas generating cartridges to eject the missile downward an approximate 8 inches before the missile motor is fired. Each of the forward fuselage stations has a cavity door that closes after the missile is gone, to smooth the contour of the fuselage. Each launcher is electrically and mechanically protected from inadvertent firing of the ejector cartridges by a safety pin which is removed prior to flight.

AIM-4D LAUNCHER

An AIM-4D launcher set group (figure 1-61, sheet 2) consists of the MAU-12B/A armament pylon, the inboard AIM-4D launcher, and the bottom (lower) AIM-4D launcher. The inboard launcher contains all the electrical and electronic gear for both launchers. The inboard launcher is bolted to the inboard side of the MAU-12B/A armament pylon. The bottom launcher is suspended from the MAU-12B/A armament pylon. Ejector cartridges are not installed in the armament pylon. The AIM-4D launchers cannot be jettisoned. Electrical connections for missile prelaunch signals are accomplished through an umbilical connector from the aircraft power source within the pylon.

During ground operations, the missile electrical connector is disconnected to prevent inadvertent firing and must be connected prior to flight. The AIM-4D is interlocked with trailing edge flaps to prevent interference during launch. The speed brakes may sustain damage if they are extended during missile launch or jettison.

Note

- After T.O. 11L3-3-5-504, the AIM-4D launcher is modified for AF standard logic and extended cooling. After this modification, the dash number of Inboard Launcher is changed from -120 to -130. Refer to T.O. 1F-4C-34-1-1A for additional information.
- After T.O. 11L3-3-5-507, the AIM-4D launcher is modified for simplified launch procedure. After this mod, the launcher is marked with a decal ARM/START LAUNCHER (selecting missile arm starts missile cooling) and the dash number of the launcher is changed to -140. Refer to T.O. 1F-4C-34-1-1A for additional information.

LAU-7A/A LAUNCHER

Refer to T.O. 1F-4C-34-1-1A.

AERO 3B LAUNCHER

Refer to T.O. 1F-4C-34-1-1A.

AGM-12 WEAPON SYSTEM (F-4E)

This section describes the AGM-12 guided missile launching system and associated equipment, and the cockpit controls and controlling procedures. With respect to missile control and flight operations, the missiles are nearly identical. The AGM-12B and -12C missiles are both ground burst devices, with the AGM-12C being considerably greater in weight and explosive yield. The AGM-12E is basically the same as the AGM-12C, except the -12E missile is an airburst, anti-personnel device.

Note

> In F-4E (71-237) and up, the AGM-12 capability is not available. Refer to part 4 of this section for a description of the AGM missiles.

MISSION

The AGM-12 missile and associated equipment provides the radio-controlled guided missile capability to enhance the air-to-ground strike mission. With the AGM-12 system energized, the AC begins an attack (dive or level) on the target and stabilizes the airplane flight path directly toward the target. The AC attempts to maintain a constant line-of-sight (LOS) with the target throughout the missile run. The missile fire signal is delivered by depressing the bomb button (either cockpit), igniting the missile liquid-fuel engine and the tracking flares. After engine burn-out (approximately 2.0 seconds) the AC begins transmitting steering commands to the missile receiver. The system transmitter emits the r-f signals as the control selector handle is positioned in combinations of left-right or up-down movements. Hence, the AC directs the missile flight path in azimuth and elevation, causing the missile (visible tracking flares) to close on the LOS to the target.

CONFIGURATION AND SUSPENSION

AGM-12B MISSILE

A total of four AGM-12B missiles, one on each wing station may be carried and launched against tactical ground targets. The inboard and outboard AGM-12B suspension equipment for F-4E aircraft is shown in figure 1-60. Each armament pylon receives the LAU-34/A missile launcher. The branched wire bundle from the armament pylon is attached to both receptacles on the aft end of the launcher. The forward branch powers AGM-12B functions. (The aft branch powers AGM-45 missile functions discussed elsewhere in this section.) In a jettison situation, only the missile is jettisoned. The LAU-34A remains with the aircraft.

AGM-12C AND -12E MISSILES

A total of two AGM-12C or -12E missiles may be carried, one on each inboard station. An AGM-12 relay panel, installed only in the inboard armament pylon, relays the pre-arm and missile fire/release signals from the cockpit. Hence, the missile is loaded directly on the pylon (MAU-12B/A) bomb rack. In this case, the fire signal ejects the missile from the rack and the missile engine ignites immediately after ejection. A discussion of AGM-12C missile fire and jettison procedures is provided later in this section.

LAU-34/A LAUNCHER (AGM-12B CARRIAGE)

In general, the launcher (figure 1-60) is responsible for the proper dispersal of pre-heat, pre-arm, and missile fire voltage. When the aircraft main bus system is energized, power is automatically directed to missile components for warm-up purposes and the system transmitter receives standby power. Thus, the system is in a warm-up condition as soon as the main bus system is energized.

When the AC selects the AGM-12 missile on the weapon selector switch, relays in the launcher are energized that unlock the pre-arm and missile fire circuit. As the AC depresses (and holds) the bomb button, the missile battery, gyro, pneumatic control system, and warhead arming circuits are activated. The missile battery builds up to power and closes a relay in the launcher - completing the circuit between the bomb button (depressed) and the liquid engine igniter. The firing sequence takes approximately 2 seconds. The engine thrust force breaks the shear pin in the forward retention mechanism (figure 1-60), and the missile is free to launch. As the missile separates from the aircraft, the umbilical breakaway connector separates the missile system function on battery power.

If the missile must be jettisoned, the jettison signal energizes a cartridge in the launcher jettison gun assembly. The force of the expanding gas from the cartridge rotates the aft retention mechanism and slides the missile rearward, free of the launcher rail. In this case, the missile freefalls in an inert state. Only under the condition of a normal, powered launch will the warhead become armed.

AIRCRAFT COMPONENTS

TRANSMITTER AND CONTROL SELECTOR (AN/ARW-77)

With the aircraft bus system energized, 28 volt dc power is continually applied to the transmitter electron tube filaments, crystal heaters, and voltage regulator. When bomb button voltage is applied at launch, the ARW-77 transmitter signal is initiated and an internal timer (in the transmitter) begins a 50 ± 10 second cycle. The timer sustains transmitter output for the above time period after the AC releases the bomb button. The output signals from the cockpit control selector are converted into command pulses by the transmitter. The transmitter circuits code, amplify, and apply the commands to the lower UHF

antenna. Any one of the 24 command channels may be used, depending upon the crystal installed in the transmitter. The transmitter crystal assembly installed must match that of the missile receiver.

The control selector (figure 1-64) receives power directly from the transmitter and in turn applies command output voltages to the transmitter circuit. With the control handle in the neutral position, the system continually emits a neutral or reference signal. Movement of the handle causes signal changes with respect to the reference signal. The amount of change is directly proportional to handle displacement. A further discussion of control handle functions and the command link (adaptive control) system is provided in later paragraphs.

Transmitter output to the missile is always emitted through the lower UHF antenna on the nose gear door. Any UHF radio transmission, while the AN/ARW-77 transmitter is in operation, is automatically emitted through the upper UHF antenna, regardless of the antenna switch position (UPR or LWR).

MISSILE CONTROL

ADAPTIVE CONTROL SYSTEM

The features of the adaptive control system may be described by observing the functions of an individual command. These functions (listed below) are directly controlled by AC manipulation of the control handle in the cockpit.

a. Lead Pulse.
b. Variable Pulse Rate Frequency.
c. Auto-Check Command.
d. Memory Command.

When the AC deflects the control handle providing an input voltage to the transmitter, circuits in the transmitter develop command pulses by repeatedly conducting and then deenergizing; applying and removing voltage for transmitter pulse output. The net result is that the missile canards momentarily deflect and then return to neutral as each pulse is applied, continuing the pulsating deflections as long as the handle is displaced. The canards always deflect fully with each pulse, regardless of the degree of control handle displacement. As an example, assume that the AC - having launched a missile - applies an up correction by moving the handle aft. Further, assume that the stick is deflected about one-half travel at time T_0, and then returned to neutral at time T_1 (figure 1-63). In the figure, off time refers to the time between pulses when the canards are neutral; on time refers to pulse duration, which corresponds to canard deflection time.

Since an up correction is necessary, the missile is low with respect to the LOS and probably going lower due to the effect of gravity. Also, note that the AGM-12C/E missile is ejected and not launched, which applies another force component to the missile normal to the LOS. Hence, as the AC moves the stick, the command must initially apply enough energy to rotate the missile axis and change its course, and in some measure account for the time lag in the command link system. The lead pulse, that functions to quicken missile response for the above reasons, is applied for a longer period that subsequent pulses as figure 1-63 indicates. The width, or on time, of the lead pulse is proportional to how rapidly the AC moves (or accelerates) the stick to the desired position. A rapid movement delivers a lead pulse of greater duration than that of a gradual movement. This is in keeping with the natural tendency to correct rapidly if the AC notices a large error developing. Conversely, the lead pulse function points out the necessity of using gradual, smooth, control stick movements in instances where missile steering is extremely sensitive, or where steering errors are small.

As long as the control handle is held in the deflected position, the pulse train continues. After the lead pulse, subsequent pulses are short at first, increasing in duration (time) as the stick is held. This means that the canards are deflected for increasing periods of time with each pulse. If the AC increases the amount of handle deflection, the amount of pulses per unit of time increases, or in other words, the frequency increases. Hence, the pulse rate frequency varies proportionally with the amount of handle displacement. If the handle is displaced to full travel, the pulse is continuous and canard deflection is continuous. This is the same as stating (regarding figure 1-63) that of time decreases and on time increases as handle displacement increases. The idea is that the AC deflects the handle a specific amount for an observed error. Then as the missile is observed to correct toward LOS at a satisfactory rate, handle deflection may be reduced so that the amount of error and command pulses delivered approach a condition of balance. Small random errors are then corrected by slight, smooth handle movement about the neutral position.

As the handle is returned to neutral at time T_1, the automatic check command is delivered. The check pulse performs very nearly the same function as the lead pulse, but the situation is reversed. As the missile corrects and approaches the LOS, a force must be applied to rotate and align the missile axis with the LOS - preventing overshoot. Just as the lead pulse, the pulse duration of the check command is proportional to the rate of handle movement to neutral. If the AC notices an overly rapid rate to closure with the LOS, he would naturally return the handle to neutral at a rapid rate. Thus, the AC is able to reduce lateral or vertical acceleration without handle deflection in the opposite direction.

After control handle voltage is removed, the system automatically generates small memory commands at a constant rate. These commands will continue throughout missile flight unless they are countered by stick movement in the opposite direction. The frequency of the memory commands is a function of the amount and duration of the initial handle displacement. A small handle deflection held for a long duration can develop the same memory as a large handle deflection held for a short duration. The memory circuits function to aid in overcoming natural forces

CONTROL HANDLE vs. CANARD DEFLECTION F-4E

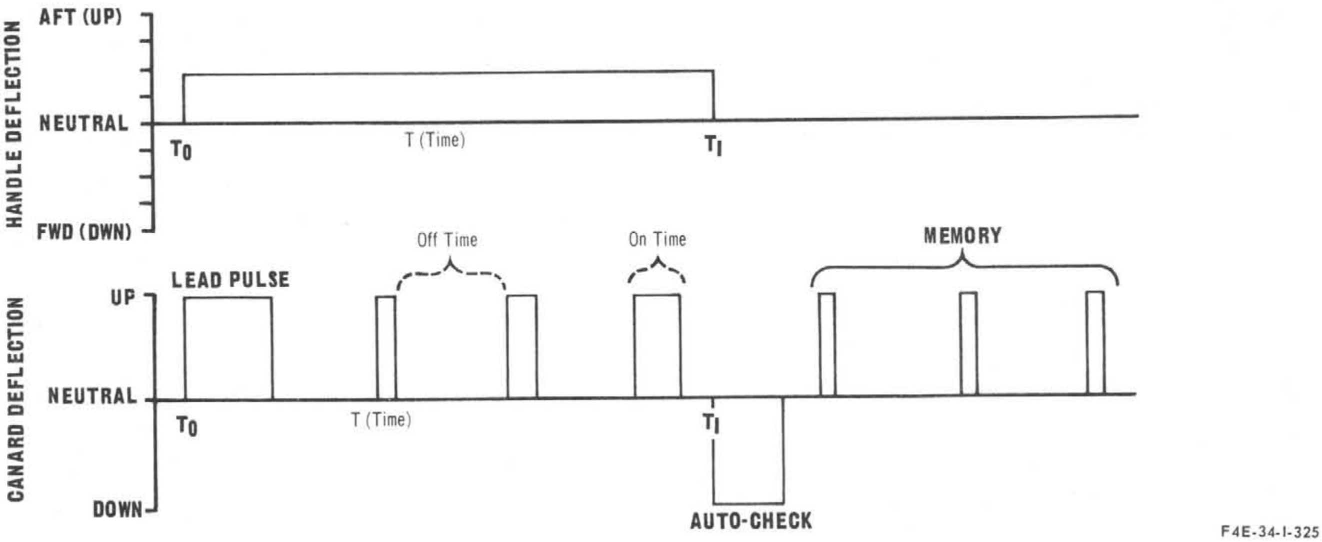


Figure 1-63

continually acting on the missile. In the example command cited here, the up memory would serve to compensate for further gravity drop.

In view of the above, one can visualize the system when handle movements are made in directions other than the cardinal ones. If the handle is moved to deliver an up-right command for example, the command sequence in figure 1-63 is applied in both up and right directions simultaneously. The point to be made is that the AC need not restrict control movement to cardinal directions only, but may use combinations of the cardinal commands and vary their magnitude.

CONTROL CONSIDERATIONS

The above discussion treats the system somewhat ideally for purposes of demonstration. In practice, there are several more things to consider. The AC must establish the desired LOS with the wings level, applying enough forward trim to counteract the tendency for the nose of the aircraft to rotate as velocity during the dive increases. Remember that the missile gyro is uncaged while the missile is still on the launcher, and that the gyro establishes a vertical reference relative to the position of the aircraft. Thus, if the aircraft is in a 45° left bank at launch and subsequently rolled level after launch, an up-command will result in the missile steering up-left.

When firing the liquid engine, the missile is plainly visible at launch. Engine burnout is identified by a puff of white smoke. The AC must ensure no commands are issued until after engine burnout. The AC will obtain best results if he can avoid the natural tendency to fix his vision on the missile flares after launch. Rather, keep the eyes fixed on the target (or impact point on the target) and view the missile flares through the peripheral vision. The picture is similar to the pipper light floating on the wind screen. This procedure will help maintain a steady LOS.

In most cases, the missile appears below the target and to the left or right, depending upon the wing station used. If the missile is low, the first feasible command is the up command to initiate the upward correction, and to help counteract further sink due to gravity by establishing up memory. At the lower release angles, the effect of gravity will be greater. If the missile is initially high before any commands are issued, allow gravity to correct the elevation error. A down command with down memory, plus the effect of gravity, is sure to result in overshoot before the LOS. With all systems functioning normally, the command link system is most sensitive during the first few seconds after engine burnout. Hence, use smooth control action to establish a desirable corrective *trend* toward LOS, rather than attempting to eliminate all sources of error immediately. Missile steering tendencies will vary, that is, some missiles will be more sensitive than others. When applying the initial command, however, all missiles should be regarded as *very* sensitive; it is easier to add more handle displacement than to correct an over-controlled missile.

The AC can get an idea of how much handle deflection is needed by observing missile trend. To illustrate, suppose the flares are observed to move from left to right toward the LOS at a rapid rate. At the instant the flares move into and coincide with the LOS, the apparent error is zero, but the error trend remains very large since the angle between the missile axis (or flight path) and the LOS is relatively large. In this case, considerable control movement, with proper lead, would be necessary to avoid overshoot. However, if the missile is considerably wide but generally holding position relative to the LOS, the missile axis may be considered to be nearly parallel to the LOS. In this case, a lesser control deflection is necessary to divert the missile and the AC uses smooth control input, varying handle deflection only to establish a controllable correction rate.

If the missile can be established at a point close (and parallel) to the LOS early in flight, there should never be any need for large, rapid, control handle movements. In fact, during this early phase of missile flight, the AC will usually have to use conscious effort to avoid overcontrol. With the adaptive system, a small degree of handle displacement held for a longer time produces the same effect as a full deflection for a very short interval. The former is by far the more desirable, however, since the trend of missile correction is more easily judged. The confusing effect of gravity must be kept in mind, and possibly used to advantage. As dive angle increases that component of gravity that tends to pull the missile down from the LOS becomes less. However, if the missile steers slightly high, up memory will probably not be sufficient to continuously hold the missile high and gravity may be used to make the necessary correction. The AC must avoid anticipating the impact, and continually fly the missile until impact is observed.

Roll Reference Shift

The description of the AGM-12 gyro system (part 4) points out that at supersonic velocity, the missile roll rate is an average 500° per second. Further, the pickoff brushes in the gyro are biased 50° to compensate for 0.1 second time lag in the command link system. As the missile decelerates, however, and approaches the transonic region (Mach 1.1 to 0.9), the lift force at the wing tips increases rapidly and causes a rapid increase in roll rate. Missile roll can increase to an approximate maximum rate of 1000° per second. Thus, maximum shift becomes approximately 100°, which means that the original 50° bias no longer compensates for the command lag and missile response would occur 50° counterclockwise from the desired response. It is difficult to predict the point at which roll reference shift begins since one must consider factors such as launch angle, launch velocity, and individual control technique which directly effects the rate of missile deceleration. If the technique of steering the missile along the LOS is executed properly, the buildup rate of roll reference is very slow and actual observance of the shift phenomenon is impossible.

A rule-of-thumb method has been devised that - knowing a desired time of flight (T_f) - may be used to determine launch altitude (AGL) for a specific dive angle. The method makes use of a factor which corresponds to a specific T_f as follows:

Factor	T_f
0.3	10 sec.
0.4	15 sec.
0.5	20 sec.
0.6	25 sec.
0.7	30 sec.

For example, assume the AC begins the dive on target, establishes LOS, and observes the dive angle to be 35°. If the 20 sec. T_f is planned, the factor of 0.5 is applied (above) so that launch altitude (AGL) is:

0.5 x 35° dive = 17.5 thousand feet AGL.

If target altitude is 1500 feet MSL, indicated launch altitude becomes:

17.5 + 1.5 = 19.0 thousand feet.

The above method is accurate (AGM-12B missiles) within ± 2 seconds for dive angles within 15° and 45°, and launch airspeeds between 300 and 600 KTAS.

OFFSET DELIVERIES

All previous considerations stated apply to offset deliveries. In this delivery, the LOS continually rotates. For example, if the target is approximately 10° right at launch, it may move to a relative position of 40° right at impact. In view of the shift phenomenon discussed, the target must always be offset to the right. In a shift environment, a right command would result in an up-right response, a relatively easy situation to control. A left command, however, would result in a down-left response, which is nearly impossible to control in an offset mode. In any delivery situation, the rate of LOS rotation can be reduced by reducing airspeed to as low a rate as the situation permits.

COCKPIT CONTROLS

The F-4E aircraft pedestal panel configuration is shown in figure 1-43. The following discussion pertains to the deployment of AGM-12B, -12C, and -12E missiles.

WEAPON SELECTOR KNOB

On the pedestal panel, the AC selects the AGM-12 position with either missile aboard. This selects the required firing system by closing relays in the launcher (AGM-12B) or in the inboard pylon AGM-12C relay panel. In this function, the intervalometer is placed in a singles output mode so that missile fire voltage is directed only to the selected wing station. Finally, selecting AGM-12 closes one portion of the transmitter-activate circuit; the transmitter may be tested after energizing the master arm switch.

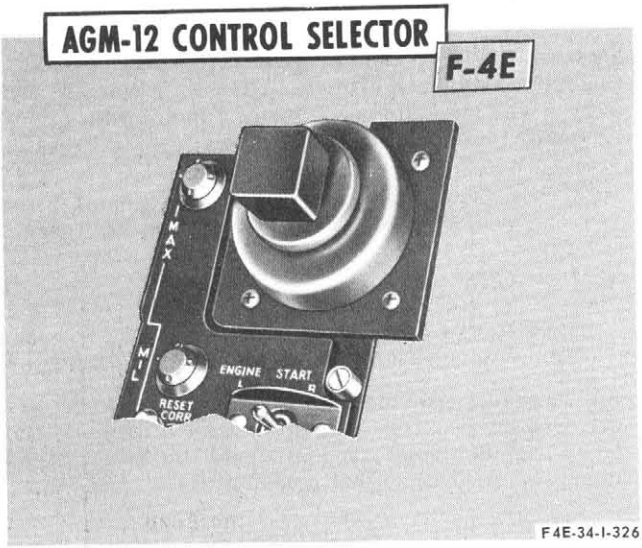


Figure 1-64

MASTER ARM SWITCH

Placing the master arm switch to ARM energizes the bomb button transfer relays, which will direct bomb button voltage into the conventional weapons circuits. The transfer relays will not energize, however, if any of the special weapons release relays (5) are energized. Thus, either the DCU-94/A master release lock, of the station select (all 5), or the consent switch must be off. Selecting ARM immediately closes the bomb button/transmitter-activate circuit. If, at this point, the AC depresses the bomb button, the system transmitter begins the 50 ± 10 second cycle. Hence, this method may be used to test (while airborne) the aircraft portion of the command link system. The station select buttons must remain off to avoid firing the armament.

Note

- For transmitter ground test purposes, a Gam-Aux switch is located in the nose wheel well.
- To perform any AGM-12 functions that are executed through the bomb button, the delivery mode selector must be positioned on DIRECT.
- The Good Guidance Monitor (GGM) performs a safing function in the AGM-12E fuzing system (refer to section 4 of T.O. 1F-4C-34-1-1A). In F-4E aircraft, the function is activated during missile flight by pulling the armament power circuit breaker (6B), No. 1 panel in the rear cockpit. Pulling this circuit breaker deenergizes AN/ARW-77 transmitter output.

STATION SELECT BUTTONS

These controls are pushbutton switches containing green and amber indicator lights inside the button housing. The green light simply indicates that a specific button has been depressed. Therefore, if one or more buttons are on, the green lights will illuminate immediately as the a-c bus system is energized. Both lights are tested through the test control on the right console.

Each button selects a specific station by energizing the corresponding station select relay, which must be energized to get launch voltage to the missile. The amber light, however, serves several purposes. With a specific button depressed, the light indicates:

1. That the pylon wire bundles are properly installed for the specific station selected. In the case of the AGM-12B, the light indicates that the LAU-34/A launcher bundle is plugged into the proper pylon receptacle. With the AGM-12C or 12E aboard, the light indicates that the AGM-12 relay panel is properly connected into the aircraft/AGM-12 circuits.
2. That the station select relay is closed, which connects bomb button output to missile launch circuits.
3. That the master arm switch is positioned to ARM, which closes another interlock in the bomb button circuit.

Thus, the amber light simply indicates that the aircraft is properly configured for the weapon selected, and provides a complete launch-ready signal. When the bomb button is depressed, launch voltage is directed through each station relay in the following order:

1. Left OUTBD (LO)
2. Left INBD (LI)
3. CL
4. Right INBD (RI)
5. Right OUTBD (RO)

In order to fire an AGM-12B missile from the RO station, all of the other station select switches must be off. To fire the LI station missile, only the LO station must be off. The CL button is included even though this station is not AGM-12 capable. This merely points out that it is impractical to energize all stations at once with several AGM-12 missiles aboard. Rather than commit the above order to memory, the AC may simply select one station at a time, and after firing the selected missile, place that station off before selecting the next.

JETTISON CONTROLS

The controls by which the AGM-12 missile may be jettisoned are shown in figure 1-59. The AGM-12C and -12E missile is jettisoned (ejected) directly from the MAU-12 rack in the armament pylon. The AGM-12B missile is jettisoned (kicked) rearward by the LAU-34/A launcher jettison gun assembly.

COMBAT SUPPORT EQUIPMENT

OPTICAL SIGHT CAMERA, KB-25/A

After T.O. 1F-4E-558, the KB-25/A 16mm gunsight camera is installed just above the optical display unit (ODU) and along the centerline of the sight combining glass (figure 1-64A). The camera is operated to provide film documentation of the sight picture during munition delivery modes in which the optical sight is in the primary aiming reference. The camera may be operated with or without the expenditure of munitions by using controls available in either cockpit.

The KB-25/A system consists of the camera body, lens assembly, and a 100-ft capacity magazine or a dummy magazine. The lens covers a field of view of 8.25° in azimuth and 16.0° in elevation. The elevation limits are +3.0° to -13.0° with respect to zero boresight line. In addition to the KB-25/A camera, the following aircraft equipment is added or changed to comprise the complete camera system.

a. A new instrument panel center glare shield is installed to accept the camera.
b. Gun camera pre-run switches are added to both cockpits. The aft switch is mounted on the lower left edge of the main instrument panel. The forward switch is beneath the canopy sill on the left side.
c. The forward cockpit stick grip is replaced with a new grip containing a two position trigger switch. The first detent is referenced here as trigger 1; the second detent is trigger 2.

CAMERA OPERATION AND CONTROLS

The camera receives motor power as soon as the aircraft bus system is operating. The only control that operates the camera on the ground is the camera run (test) button on the right side of the camera. With the button depressed, the AC can watch the motor knob and check that the motor is running (figure 1-64A). This may be accomplished immediately with no other control procedure necessary.

The remaining controls on the camera body are the frames per second (FPS) switch, the overrun dial, and the aperture control shown in figure 1-64A. The FPS switch controls film speed; either 24 or 48 frames per second. The overrun dial is set on the required time period the camera is to run after the AC releases the trigger or bomb button. (The overrun function does not operate unless trigger 2 or the bomb button is used to operate the camera.)

Bomb Button

For the bomb button (either cockpit) to operate the camera, the delivery mode selector must be on DIRECT, DIVE TOSS, or DIVE LAY. The bomb button signal energizes the camera motor, the overrun period, and the event marker. The event marker appears on the film to mark the application of the weapon launch/fire signal.

Trigger Switch (Trigger 1 and 2)

The trigger 1 position of the trigger switch operates only the camera motor; the event marker and overrun period do not operate in trigger 1. The trigger 2 position runs the camera, and energizes the marker and overrun time. If armament is to be expended, only the trigger 2 position applies the fire/launch signal, provided the remaining weapons controls are energized.

WARNING

On aircraft modified by T.O. 1F-4E-558, continuous gunsight camera operation after takeoff and before initiation of any camera operational mode indicates a possible malfunction in the armament circuit that could cause premature firing of the gun, air to air missiles, or prevent the normal release of the MK 1 Mod 0 Walleye. All trigger function armament switches should remain OFF/SAFE.

If the AGM-45/62 position is selected on the pedestal for walleye operations, the trigger is locked out and only the bomb button operates the camera.

Gun Camera (Pre-Run) Switches

The camera may be operated through the gun camera (pre-run) switches added to each cockpit. With either switch in the ON position the camera runs continuously until the switch is placed OFF, or until the bomb button or trigger 2 is applied.

OPTICAL SIGHT CAMERA, KB-25/A F-4E

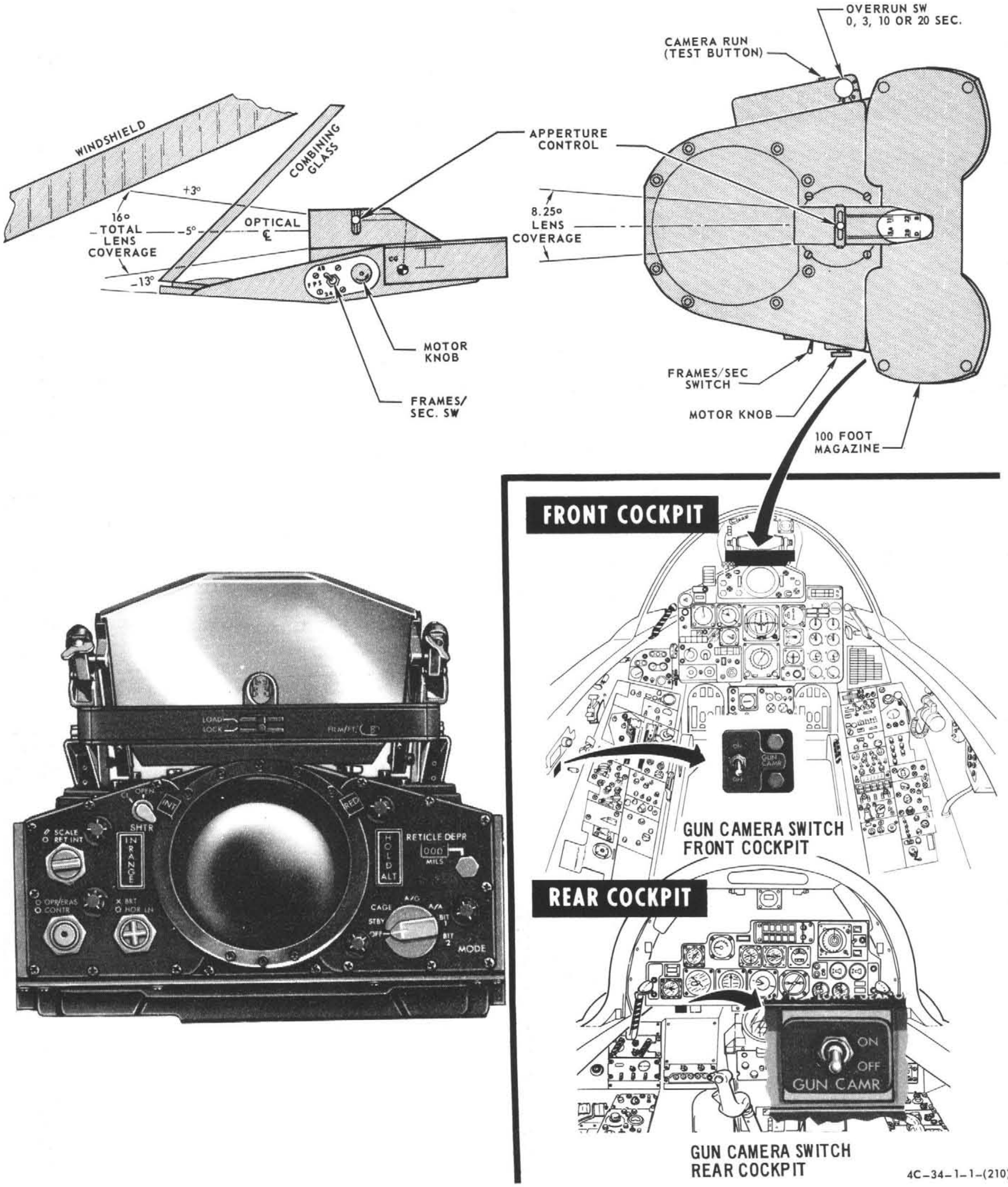


Figure 1-64A

PART 4 DESCRIPTION F-4C D E

TABLE OF CONTENTS

COMBAT WEAPONS

The non-nuclear weapons and associated fuzing components are described and illustrated in the following pages. Bombing tables (or ballistics tables) are available for these munitions in T.O. 1F-4C-34-1-2 and -2A. Only limited information with respect to weight, drag, and dimensions of these munitions are shown in this manual. Total aircraft drag and total gross weight, which are important factors for mission planning, must be determined by referencing T.O. 1F-4C-1-1 flight manual performance data. For example, to compute the total drag index, multiply the number of bombs aboard by the bomb drag index, and add the suspension equipment drag (shown in the flight manual) for each loaded station. The normal release sequence for F-4C/D/E aircraft are shown in their respective parts of this section. A Bomb/Fuze compatability chart is provided; refer to Bomb Fuzes, this part.

GUN PODS

SUU-16/A GUN POD

The SUU-16/A gun pod (figure 1-66) contains the M61A1 20mm gun, a RAT (ram air turbine) drive assembly, an ammunition feed assembly, an electrical control package, and the ammunition drum. The M61A1 gun has six barrels that rotate. Each barrel fires once per revolution to fire a total of 6000 rounds per minute (100 rounds per second) when the gun is rotating at 1000 rpm. The muzzle velocity is 3380 feet per second. The M61A1 gun fires electrically primed, steel case, 20mm ammunition, M50 series, type TP (ball, used for target practice), HEI (high explosive incendiary) and API (armor piercing incendiary). The gun pod has an ammunition capacity of 1200 rounds, of which approximately 50 to 70 rounds are unusable.

CAUTION

- The usable ammunition in the pod can be completely fired out with a single burst, or fired in short bursts; however, to reduce possible gun damage and prolong gun life, a single burst should not exceed three seconds.

- Firing bursts in the AUTO CLEAR mode with less than a 2-second interval will cause extensive damage to the gun.

The gun has two operating modes that can be selected inflight: AUTO-CLEAR and NON-CLEAR. The purpose of the auto-clear mode is to remove live rounds from the firing position at the completion of each burst. The purpose of the non-clear mode is to preclude the ejection of live rounds from the gun and to provide immediate gun firing when the trigger is pulled.

The RAT (ram air turbine), mid-way along the right side of the gun pod, is extended into the airstream when electrical power is applied to the gun pod. Electrical power is received from the aircraft, converted within the gun pod, and used to fire the cartridge and operate the clutch/brake actuator solenoid. Mechanical power to rotate the gun is received from the RAT; therefore, the RAT directly controls the rate of fire. The RAT rotates at a constant speed to provide mechanical power to drive the gun and the ammunition feed system. The speed of the RAT is maintained at 12,000 ± 600 rpm by a mechanical governor. Any change in rpm will cause the governor to change the turbine blade pitch accordingly to maintain a constant speed. A minimum airspeed of 330 knots CAS (Mach 0.5) is required to drive the system at a steady rate of 12,000 rpm. The gun can fire at lower than 330 knots CAS; however, the rate of fire will diminish. The clutch assembly transmits the power developed by the RAT to the ammunition feed system and the gun. When the trigger switch is actuated, a drive clutch is engaged by a solenoid to place a gear train in action which reduces the 12,000 rpm to rotate the gun at 1000 rpm, which causes 6000 rounds per minute to be fired from the gun.

During a non-firing condition, the RAT free-wheels while the gun and feed system are held fixed by the brake band. When the fire command is given, a solenoid engages the clutch band against a drum and releases the brake band to allow the RAT to drive the system. The ammunition drum stores the major portion of the ammunition.

During firing operation, the ammunition drum discharges the ammunition into an endless conveyor unit which picks up each cartridge and delivers it to the gun. The cartridges are placed into the gun, as it rotates from the lower right side, where a cam-operated sliding bolt assembly picks up the cartridge and carries it forward and locks it in the breech (or firing position). The cartridge is fired as it passes an electrical contact, and the empty case is extracted as the gun rotates toward the lower left side. The empty case (or a dud cartridge) is extracted from the breech and ejected from the lower left side of the pod by the case ejector with sufficient velocity to clear the aircraft.

At the end of each burst, in the AUTO-CLEAR mode, an automatic clearing function is initiated which prevents the bolts from carrying the cartridges forward into their breech position during gun deceleration.

to clear the gun of live rounds. A live round remaining in the breech after a long burst in the non-clear mode could cook off if the gun is hot. This will not cause the gun to malfunction. When a gun malfunction occurs, the cause will most often be the jamming of the feed system. Another type of malfunction that might occur, is the jamming of the bolt assembly operation in the auto-clear mode; the non-clear mode is not susceptible to this type of malfunction.

CAUTION

Firing bursts in the AUTO-CLEAR mode with less than a 2-second interval between bursts will cause extensive damage to the gun.

Complete fire-out of all ammunition is not possible; approximately 50 rounds must remain in the feed system to maintain control of the flexible feed chute. A last-round switch is in the ammunition drum to stop the feed system before the last round in the ammunition drum reaches the feed system. Firing voltage is removed by the last round switch as if the trigger switch were released, and the auto-clear clearing action is initiated regardless of the mode selected; all cartridges are removed from the breech.

The M61A1 gun can develop 3800 pounds of reverse thrust when firing at its maximum rate. Since the guns are mounted below the aircraft center of gravity, the reverse thrust of the centerline gun will cause the pipper to rotate downward approximately 5 mils. The two outboard guns will also cause a downward rotation and to a greater degree; approximately 8 mils. One outboard gun can be safely fired; however, the reverse thrust will cause the pipper to rotate in azimuth (yaw approximately 8 mils) toward the operating gun. For short bursts of less than 1 second, the reverse thrust of the guns will cause negligible movement of the pipper and, consequently, the shot pattern. The AC should anticipate the effect of reverse thrust and aim at the top of the target, or to the side of the target.

CAUTION

A maximum burst time of 3 seconds should be observed to reduce possible gun damage.

Note

- If the gun control switches and the missile control switches are positioned for firing, only the guns fire when the trigger switch is actuated. The position of the missile arm switch has no effect on the gun firing circuits.
- The guns can be fired with flaps down and/or speed brakes deployed.
- F-4D-28 and up, the forward fuselage AIM-7 missiles can be launched when the gun pod is mounted on the centerline station.

SUU-23/A GUN POD

The SUU-23/A gun pod is similar to the SUU-16/A gun pod, except it contains the XM130 gun and does not have a ram air turbine (RAT) drive system. Instead, it has an internal electric inertia start motor which accelerates the gun. With the gun selected, the inertial start motor begins to develop operating speed when the master arm switch in placed to ARM. On production F-4D/E block 37 and up and on all other F-4D/E aircraft with prestart retrofit, the inertia motor in the SUU-23/A starts running when the station is selected, regardless of the position of the master arm switch or the weapon selector. A jumper bundle is added to the armament stations to provide selective pre-start capability. Pre-starting of the inertia motor through the station selector buttons eliminates the 20 to 30 second delay in firing after master arm.

CAUTION

The station select buttons immediately energize the SUU-23 gun pod pre-start circuits and start the gun inertial motor. To avoid inertial motor burn-out, avoid selecting the stations during ground operations or any operations not directly involving the gun pod. This also applies to SUU-23 pods mounted on INBD stations (2 and 8) after T.O. 1F-4D-558.

When the trigger is pulled, the inertia starter accelerates the gun to 5400 shots per minute. At 5400 shots per minute, the inertia starter disengages and a gas drive system extracts gun gas from four of the six barrels to further accelerate the gun to the maximum firing rate of 6000 shots per minute. With the motor operating at duty speed, maximum gun firing rate is obtained 0.2 to 0.4 seconds after the trigger is pulled.

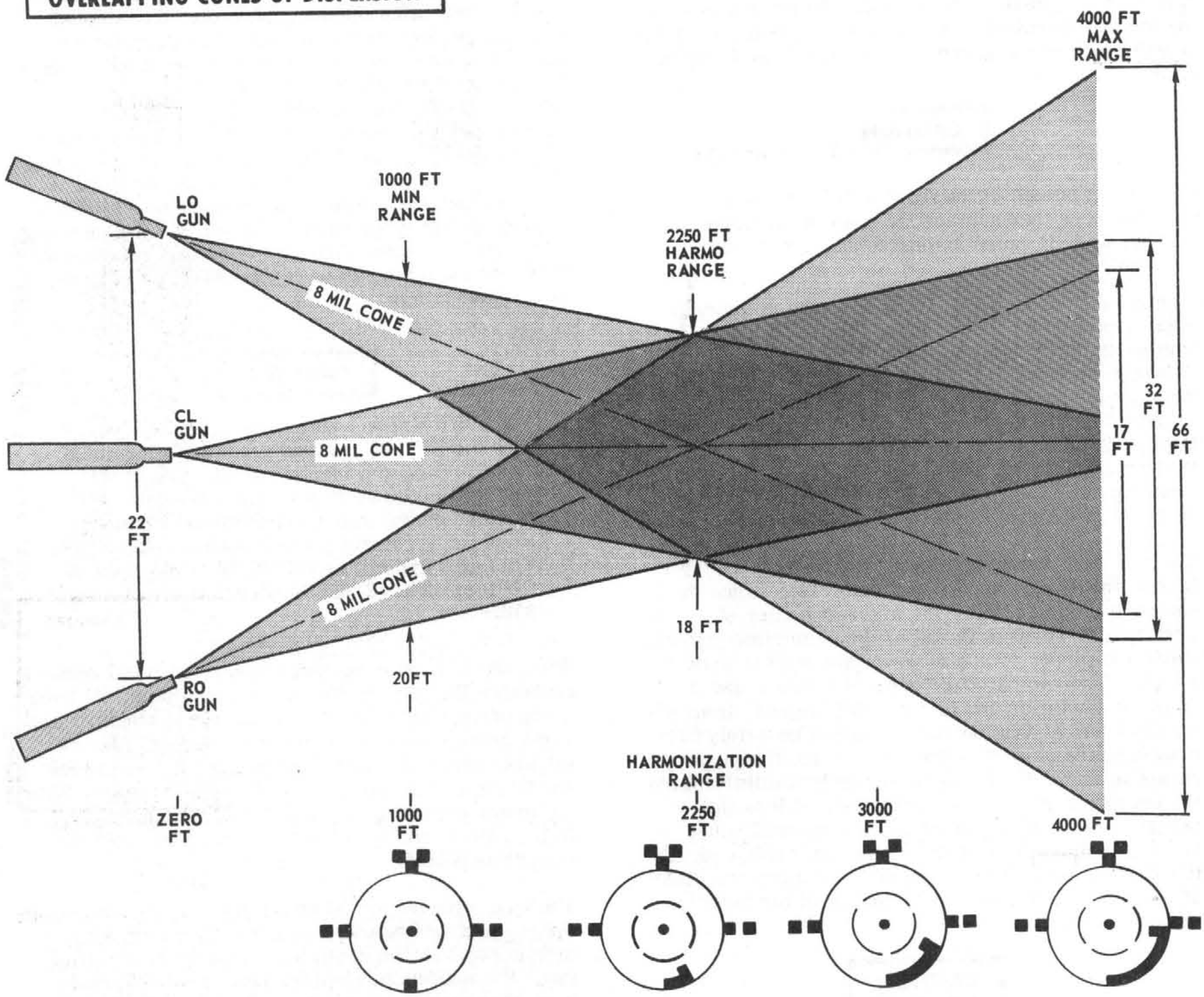
The gas drive system sustains the driving rate of the gun and linkless feed system. The electric inertia start motor disengages, but continues to run. If a malfunction occurs (such as misfire of four or more consecutive rounds), or if the driving rate falls below 900 rpm (5400 shots per minute), the electric inertia start motor engages to achieve firing rate, and again disengages. All data pertaining to the SUU-16/A gun pod is applicable to the SUU-23/A gun pod except when noted.

HARMONIZATION

Figure 1-67 illustrates the convergent method of gun pod harmonization. The convergent method provides maximum projectile density at the harmonization range (2250 feet). Further information is provided in section IV, Supplementary Data. Figure 1-67 also shows the position of the optical sight range bar at the 1000 through 4000 foot range indicating positions. The range bar is available only in the lead compute operating mode with radar lockon.

HARMONIZATION RANGE

OVERLAPPING CONES OF DISPERSION



Note

- The values are approximations to illustrate the lateral dispersion and density at various firing ranges.
- After T.O. 1F-4-558, gun pods may be loaded on left and right INBD stations (2 and 8).

4C-34-1-1-(67)

Figure 1-67

WINGSPAN VS. TARGET RANGE

Another device for quickly estimating the air-to-air target range involves the 25- and 50-mil reticle circles and the known wingspan of the target. The AC may find the device useful if radar lockon cannot be obtained (range bar not available). Before T.O. 1F-4E-556 and without lockon the sight provides lead for a constant 1500 foot range. After T.O. 1F-4E-556, the lead range without lockon or with CAGE applied during lockon is 1000 feet. As an example, the F-4 wingspan is 38 feet. At 1500 feet range, the F-4 would diametrically fill the 25-mil reticle ring.

$$(1000)\ \frac{38\text{ ft. WS}}{1500\text{ ft. Rng.}} = 25\text{ Mils Dia. (Approx)}$$

The plot in figure 1-68 provides values of mils diameter as a function of wingspan and target range.

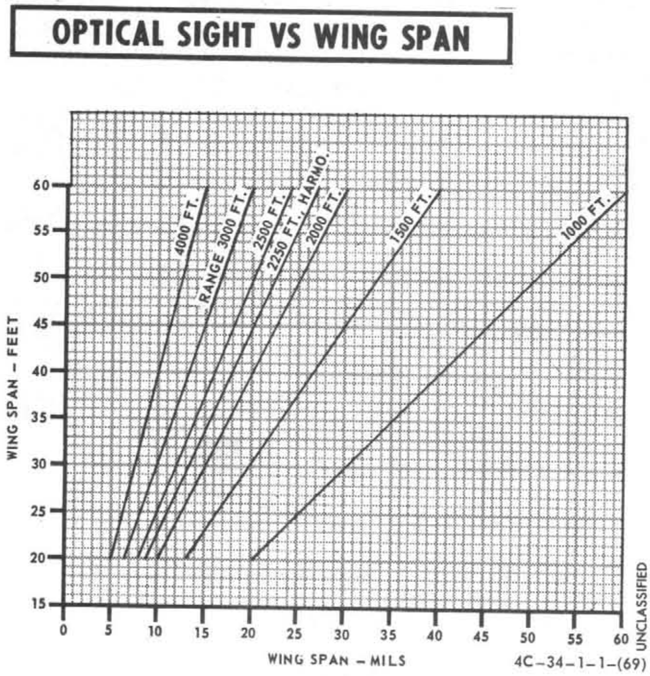


Figure 1-68

20mm AMMUNITION

The components that make up a complete round or cartridge used in the M61A1 gun are: a brass cartridge case, an electric primer, propellant powder, and the projectile. The complete cartridge is approximately 6-5/8 inches long and weighs approximately 1/2 pound (Ball, 0.5621; API, 0.5696; and HEI, 0.5664 pound). The projectile is fired when an electrical pulse is applied to the primer. The resulting flame passes through a gas vent leading to the propellant chamber which ignites the propellant in the cartridge case. As the propellant burns, it forms a gas which forces the projectile through the gun barrel.

The only significant difference between the three types of ammunition is in the projectile. Located at the rear of all projectiles is a band of soft metal that seats in the grooves of the gun barrel. The grooves in the barrel are twisted such that the projectile receives a rotating motion as it travels through and leaves the gun barrel. This rotation is induced to provide stability in flight. The soft band also serves to prevent the propelling gas from escaping past the projectile.

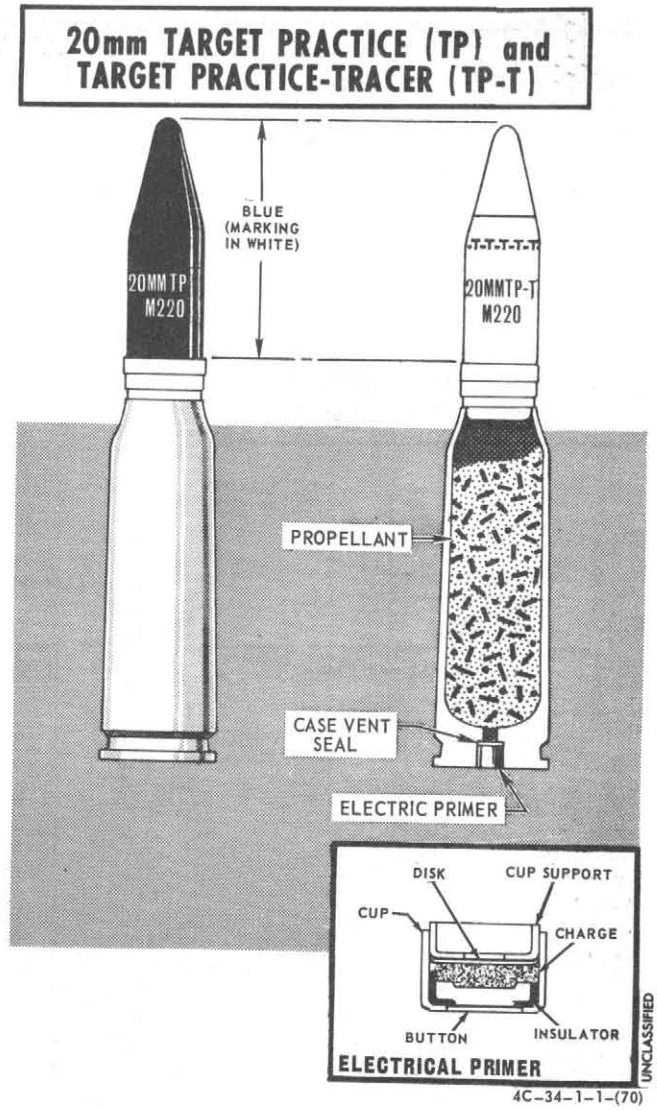


Figure 1-69

Note

The 20mm Dummy color code may be either bronze or shades of grey or tan. The case will be steel or plastic. Dummy ammo is used to check out the gun system and for loading instructions.

20mm Target Practice

The 20mm target practice cartridge (TP), figure 1-69 is ball ammunition. The body of the projectile is made of steel. The projectile is hollow and does not contain a filler.

20mm Armor Piercing Incendiary

The body of the 20mm Armor Piercing Incendiary (API) Cartridge (figure 1-70) is composed of solid steel. The nose of the projectile is made of aluminum alloy, charged with an incendiary composition, and sealed with a closure disk. The projectile does not require a fuze since it functions upon impact.

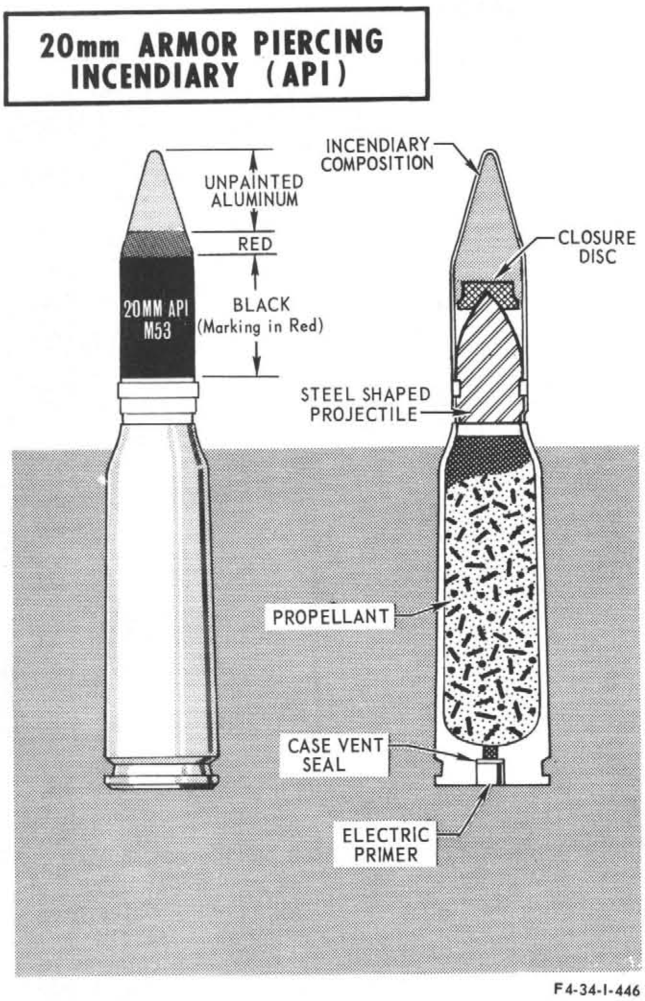


Figure 1-70

20mm High Explosive Incendiary

The primary use of the 20mm High Explosive Incendiary (HEI) Cartridge (figure 1-71) containing an HEI projectile, is against aircraft and light material targets because the projectile explodes with an incendiary effect after it has penetrated the surface of its target. HEI projectiles require a fuze to complete the explosive train (figure 1-71). The fuze will not function unless the detonator is in line with the firing pin. The mechanisms are arranged so that the fuze is boresafe (detonator safe). A boresafe fuze is

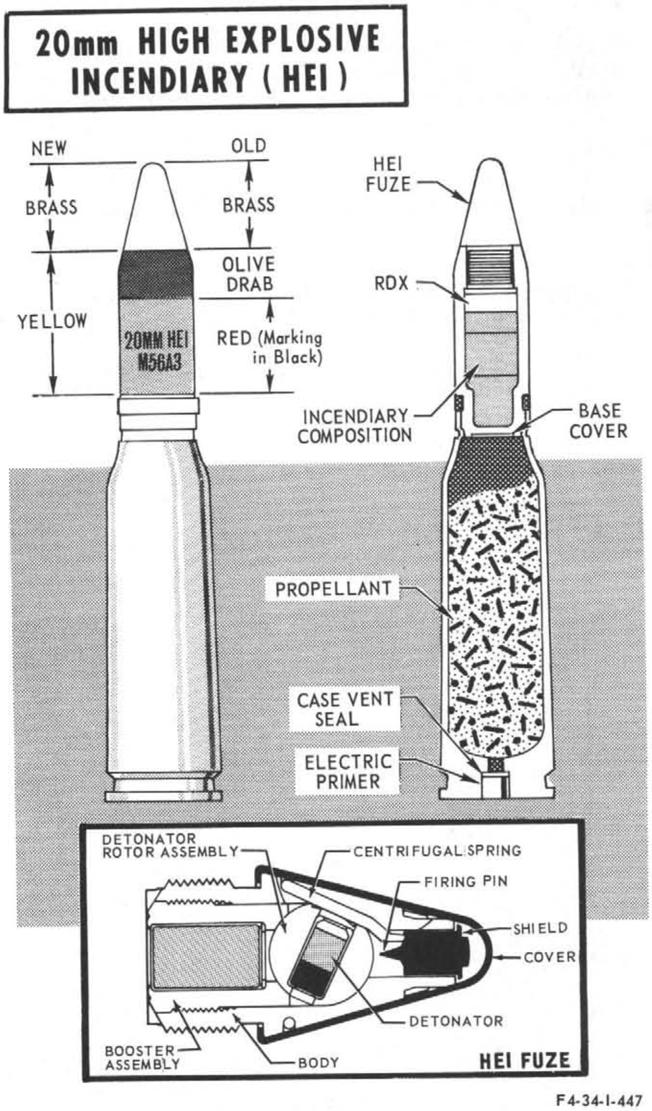


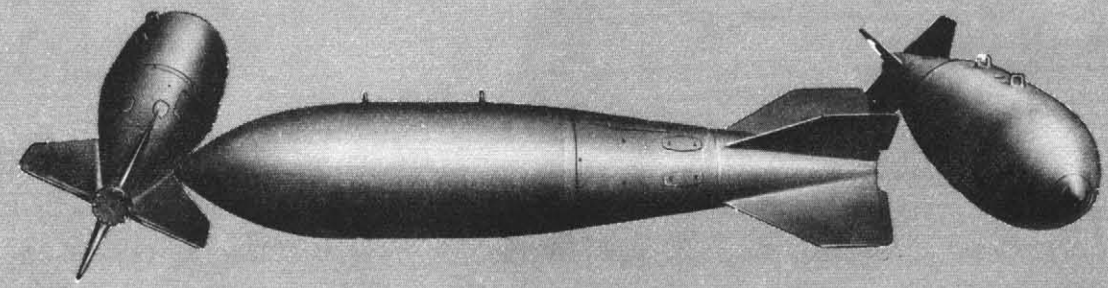
Figure 1-71

one in which the explosive train is interrupted while the projectile is still in the bore, or barrel of the gun; premature action of the bursting charge is prevented if the more sensitive element (the detonator) functions.

The fuze has a delayed arming distance of 20 to 35 feet from the muzzle of the gun. Prior to firing HEI projectiles, the rotor containing the detonator (which is out of line with the firing pin) and the firing pin are locked in position by a rotor safety spring. Centrifugal force, created by the projectile spin, allows the detonator to align with the firing pin and the booster; the projectile is now armed. Upon impact, the projectile presses into its target, crushing the nose of the fuze and forcing the firing pin against the detonator. The booster, initiated by the detonator, causes the projectile to explode.

M117 GP BOMB

M131 FIN SHOWN



WEIGHT FULL	820 Pounds
LENGTH	7 Ft., 3.4 Inches
DIAMETER	16.0 Inches
FINSPAN	22.38 Inches
SUSPENSION LUG DISTANCE:	14.0 Inches
FLIGHT LIMITS :	Refer to Flight Manual
ASSEMBLY, FIN, M131, M131A1 or MAU-103A/B	
FUZE:	Refer to Bomb/Fuze Compatability

4C-34-1-1-(73)

Figure 1-72

M117 GENERAL PURPOSE (GP) BOMB

Note

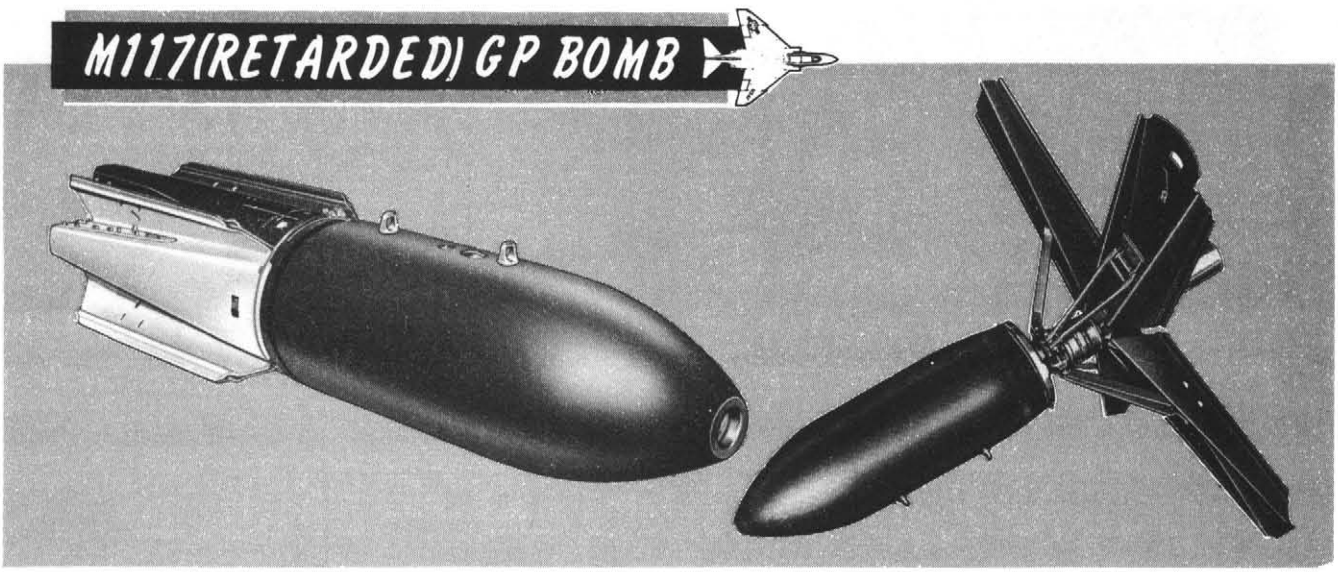
The M117 bomb with the MAU-103A/B fin has the same ballistic trajectory as the M117 bomb with the M131, M131A1 fin; therefore, the ballistic tables presented in T.O. 1F-4C-34-1-2 are applicable.

The M117 is a general purpose bomb (figure 1-72) normally used for demolition operations. The bomb has a cylindrical metal body with an ogival nose and a tapered aft section to which a conical fin assembly is attached.

The basic structural material of the bomb is steel. The bomb body is filled with approximately 400 pounds of high explosive. A fundamental characteristic of the explosive used is its relative insensitivity to ordinary shock and heat incident to loading, handling, and transporting. The bomb is designed for use with both a nose fuze and tail fuze to insure reliability of functioning and to cause the desired effect, which may be blast, mining, or fragmentation.

The M131 or M131A1 conical fin assembly consists of an elongated fin cone and four identical streamlined blades assembled perpendicular to the fin cone. The fin cone contains four access holes. Two access holes of a modified oval shape approximately 6.5 inches long, provide for installation of the bomb tail fuze and attachment of an ATU-35/B or ATU-35A/B drive assembly (figure 1-115) when an M905 bomb tail fuze is installed. The arming wires are threaded through safety devices in the fuze to maintain the fuze in a safe (unarmed) condition until after release. The adapter-boosters serve to accommodate the body of the fuzes, and to contain a booster charge which insures detonation of the high explosive charge.

Operation of the bomb commences at release when the arming wires are withdrawn, permitting the fuzes to arm. Upon impact with the target, one or both fuzes operate, igniting the explosive train which relays and amplifies the blast in order to detonate the bursting charge in the bomb. If either fuze (nose or tail) malfunctions, the other will usually cause detonation of the bomb.



WEIGHT	880 Pounds
LENGTH	7 Ft., 1 Inch
DIAMETER	16 Inches
FINSPAN, CLOSED	22.4 Inches
FINSPAN, OPEN	83.5 Inches
FLIGHT LIMITS	Refer to Flight Manual
RETARDING TAIL ASSEMBLY.	MAU-91A/B or MAU-91B/B
FUZE.	Refer to Bomb/Fuze Compatibility

4C-34-1-1-(74)

Figure 1-73

M117R (RETARDED) GP BOMB

The M117R bomb (figure 1-73) consists of an M117 warhead with the MAU-91A/B or MAU-91B/B retarding tail assembly installed. The MAU-91 fin assembly provides the cockpit selectable, high or low drag delivery option. The fin assembly replaces the standard M131 conical fin shown in figure 1-72, and is configured for a high or low drag deployment by methods of arming wire routing. The AC selects the desired option through the arm nose/tail switch on the pedestal panel. (Refer to Arming Wire/ Lanyard Routing, and figure 1-105.)

WARNING

If the in-flight high/low drag release option is used, the prescribed arming wire routing must be utilized and the warnings and notes, listed in Mission Description, parts 1, 2, or 3, must be carefully observed.

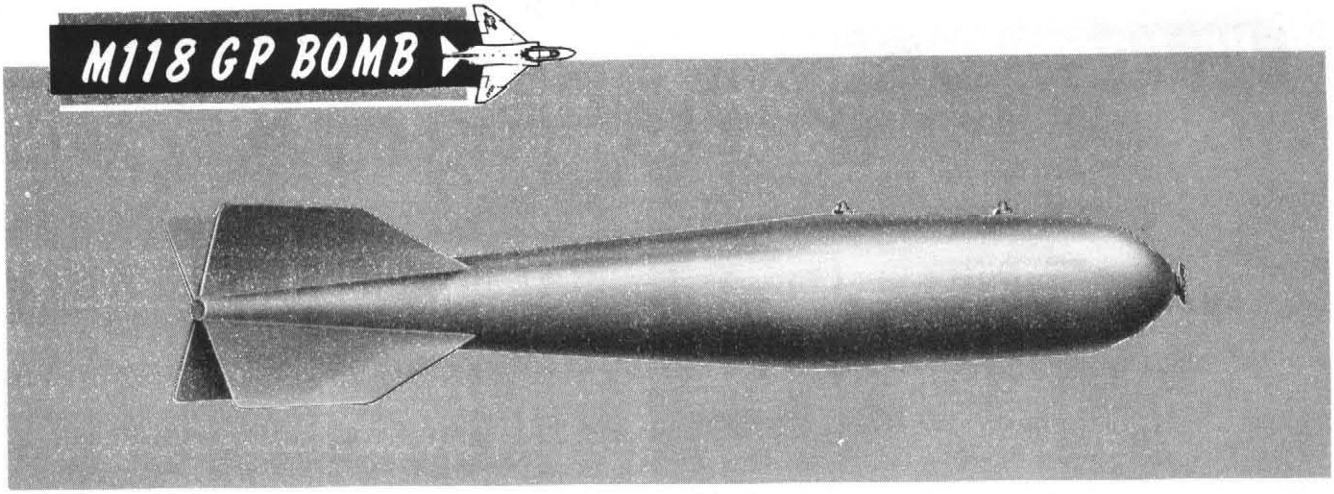
The fin assembly consists of four extentable drag plates attached to the bomb body by a flange and support tube. In the low drag configuration, the drag plates are held closed by a release band. In high drag configuration, the release band latch is pulled by a lanyard attached to the arming solenoid in the bomb rack, allowing the drag plates to deploy. The drag plates are snapped open by a leaf spring under each plate and by the airstream. The drag plates stop approximately perpendicular to the airstream to provide maximum drag area and stability.

Note

M117 silhouettes and methods of arming wire routing for the high/low drag options are shown in section II, part 4.

M117D DESTRUCTOR

The M117 destructor is identical to the M117R except that the weapon is fuzed with components of the MK 75 Mod 0 kit. The weapon is released high drag only, and for ground implant and subsequent land mine operations. Ballistic data is the same for both M117R and M117D bombs. (Refer to section II part 4, Exterior Inspection for M117R bomb.)



BOMB DRAG INDEX	10.1
WEIGHT	3,020 Pounds
LENGTH	15 ft. 5 Inches
DIAMETER	24.13 Inches
FINSPAN	33.6 Inches
SUSPENSION LUG	30.0 Inches
FLT LIMITS	Refer to Flight Manual
FUZE:	Refer to Bomb/Fuze Compatability
SUSPENSION EQUIPMENT	
BRU-5/A Ejector Rack;	
DRAG:	0
WEIGHT:	45 Pounds

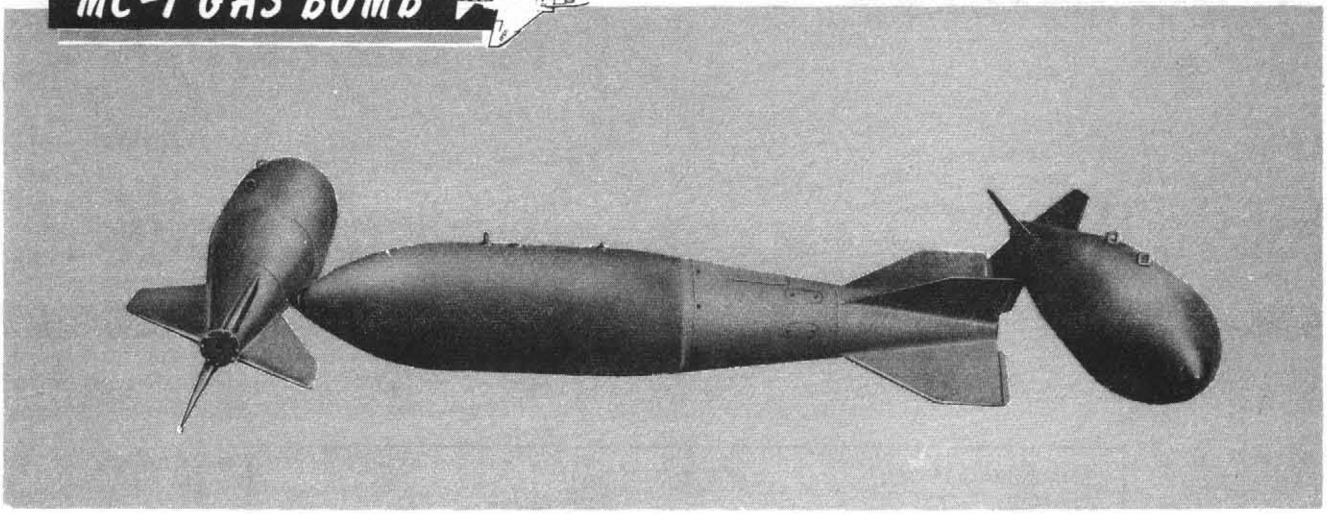
F4-34-1-450

Figure 1-74

M118 GENERAL PURPOSE (GP) BOMB

The M118 GP bomb (figure 1-74) is normally used for demolition operations (blast and mining). The bomb is loaded with approximately 1888 pounds of 80-20 tritonal which constitutes approximately 62 percent of the total weight. The bomb is adapted for use with nose or tail fuze. The M118 GP bomb is suspended from the BRU-5/A centerline bomb rack on aircraft that have been modified with arming solenoids at the centerline station (T.O. 1F-4-750). The bomb is released through the nuclear release system or through the conventional release system if a shorting plug is used. Refer to sections II and III for normal and emergency release procedures.

MC-1 GAS BOMB



WEIGHT, EMPTY.	500 Pounds
WEIGHT, FULL	720 Pounds
LENGTH	7 Ft., 6 Inches
DIAMETER	16.0 Inches
FIN SPAN	22.38 Inches
SUSPENSION LUG DISTANCE . .	14.0 Inches
FLIGHT LIMITS.	Refer to Flight Manual
ASSEMBLY, FIN, M131, M131A1 or MAU-103A/B	
FUZE	Refer to Bomb/Fuze Compatability

4C-34-1-1-(76)

Figure 1-75

MC-1 GAS BOMB

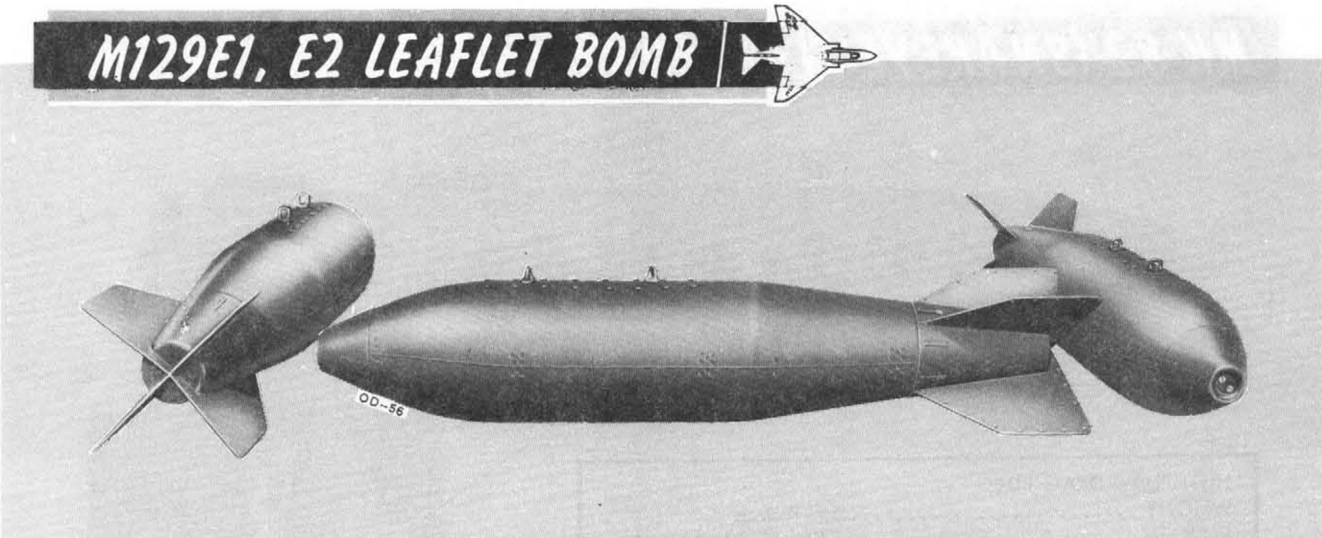
The MC-1 (figure 1-75) is a nonpersistent gas bomb designed by conversion and modification of the M117 general purpose bomb. The bomb has a cylindrical metal body with an ogival nose and a tapered aft section to which a conical fin assembly is attached. The basic structural material of the bomb is steel. The bomb body is filled with 24 gallons (220 pounds) of GB agent. The filler tube is permanently welded shut at the time filling is accomplished. The bomb is designed for use with both a nose fuze and a tail fuze. A hollow burster tube runs through the center of the bomb and connects the nose and tail cavities. Fuze wells are installed at both ends of the tube to accommodate nose and tail fuzes. Prior to loading, an M32 burster charge containing an explosive is installed in the tube.

The M131 or M131A1 fin assembly consists of an elongated fin cone and four identical streamlined blades assembled perpendicular to the fin cone. The fin cone contains four access holes. Of the authorized fuzes, any nose fuze (and components) may be used with any tail fuze (and components).

Note

Regardless of the fuze used, all will be set for instantaneous or non-delay functioning.

Other components used are arming wires and adapter-boosters. The arming wires are threaded through safety devices in the fuze, thus maintaining the fuze in a safe (unarmed) condition until release. The adapter-boosters serve to accommodate the body of the fuzes, and to contain a booster charge which insures proper operation of the burster charge. Operation of the bomb commences when it is released from the aircraft and the arming wires are withdrawn. This permits the fuze arming vanes to rotate in the airstream. After the required number of revolutions or number of seconds, the fuzes are armed. When the bomb impacts, the fuzes function, causing the burster to detonate. The detonation of the burster ruptures the bomb body and disperses the filling as tiny droplets of liquid which quickly evaporate to a gas.



WEIGHT, EMPTY	92 Pounds
WEIGHT, FULL	200 Pounds (Depends on weight of paper)
LENGTH	7 Ft., 6.02 Inches
DIAMETER	16.02 Inches
FIN SPAN	22.78 Inches
SUSPENSION LUG DISTANCE	14.0 Inches
FLIGHT LIMIT	Refer to Flight Manual
ASSEMBLY, FIN M148	
FUZES:	Refer to Bomb/Fuze Compatability

4C-34-1-1-(77)

Figure 1-76

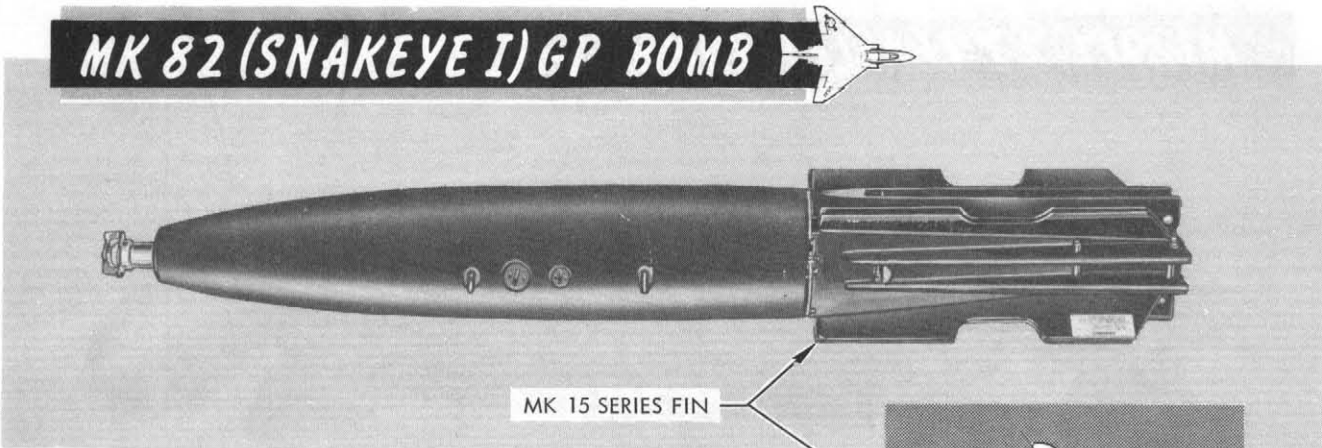
M129E1, E2 LEAFLET BOMB

The M129E1, E2 (figure 1-76) is a leaflet bomb designed for use in delivery and distribution of leaflet type materials. The bomb has a cylindrical body with an ogival nose and a tapered aft section. It is constructed of fiberglass and has an external configuration similiar to the M117 GP bomb. The bomb body is split longitudinally into two sections which are held together by four latches on each side. A steel reinforcing plate below the suspension lugs is added for forced ejection from the MER and TER. The M148 conical fin assembly consists of four fiberglass sections, glued and riveted together to form a cone about 20 inches long. Four fin blades approximately 23 inches long are attached to the cone. The fuze well, which is located in the nose of the bomb body, will accommodate a mechanical time fuze designed for airburst operation. No tail fuze is used or provided for in the M129E1, E2 bomb.

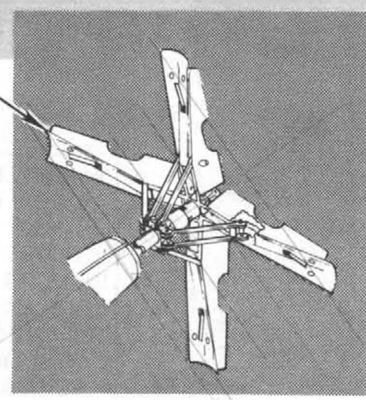
Other components include an arming wire, an adapter-booster assembly, and detonating cord (Primacord). The arming wire is threaded through the fuze safety device, thus maintaining the fuze in a safe (unarmed) condition until release. The adapter-booster accommodates the fuze and maintains the detonating cord in the proper position. The detonating cord is used to affect separation of the two bomb body sections.

Operation of the bomb occurs a predetermined number of seconds after release. Functioning of the fuze causes the booster to ignite and detonate the 12-foot length of Primacord. The Primacord is inserted through the adapter-booster and longitudinally around the entire bomb. Detonation of the Primacord separates the two body sections, detaches the fins and allows the leaflets to be released and scattered. If the nose fuze fails to function, the bomb will disintegrate upon impact.

R.H.



HIGH/LOW DRAG FIN:	
WEIGHT	560 Pounds
LENGTH	7 Ft., 5.5 Inches
DIAMETER	10.8 Inches
FINSPAN (CLOSED)	15.1 Inches
FINSPAN (OPEN)	89.3 Inches
FIN ASSEMBLIES	MK 15 Mod 3,3A, 4
FUZES:	
MK 36	MK 15 KIT
MK 82	FMU-54/B; FMU-54A/B M904E2, M904E3



4C-34-1-1-(78-1)

Figure 1-77

MK82 (SNAKEYE I) GP BOMB

The MK 82 Snakeye I bomb (figure 1-77) is a general purpose (GP) bomb with a MK 15 Mod 3, 3A, or 4 tail assembly. The nose of the bomb has a 3-inch wide yellow strip that signifies high explosive filling. The Snakeye I bombs provide the cockpit selectable, high or low drag delivery option. The fin assembly is configured for a high or low drag deployment by methods of arming wire routing. The AC selects the desired option through the arm nose/tail switch on the pedestal panel. (Refer to Arming Wire/Lanyard Routing, and figure 1-105.)

WARNING

If the in-flight high/low drag release option is used, the prescribed arming wire routing must be utilized and the warnings and notes, listed in Mission Description parts 1, 2, or 3, must be carefully observed.

In the low-drag configuration, the folded retarder blades form stabilizing fins. In the high-drag configuration, the four retarder blades are extended approximately 90° to the longitudinal axis of the bomb. The blades are hinged at the stationary clevis which is screwed into the aft end of the retarder support. Each retarder blade is linked to a sliding collar so that all four retarder blades open at the same time. The retarder blades are retained (folded) by a band with a trunk-latch fastener, and the tail release wire passes through the fastener.

Note

MK 82 silhouettes and methods of arming wire routing for the high/low drag options are shown in section II, part 4.

HIGH DRAG RELEASE SPEED RESTRICTION

The maximum release speed of the MK 82 snakeye when released high drag is dependent on which modification of the MK 15 tail assembly is used:

a. The MK 15 Mod 0, Mod 1 and Mod 2 tail assemblies are currently restricted from use on F-4 aircraft.

b. The MK 15 Mod 3, Mod 3A, and Mod 4 tail assemblies are restricted to 500 KCAS maximum release speed when released high drag.

MK36 DESTRUCTOR

This munition is the same as the MK 82 Snakeye I bomb (figure 1-77) except that the fuze components are those of the MK 36 destructor kit. The weapon

is deployed high drag only for ground implant and subsequent land mine operations. Ballistic data is the same for both the MK 82 Snakeye and MK 36 bombs. (Refer to section II part 4, Exterior Inspection of MK 82 Snakeye bombs.)

M36 MOD 2/3 & MK 75 MOD 2/3 DESTRUCTOR KITS

These fuzing assemblies are available for use with the high drag, and in addition the low drag versions of the MK82 munition. For low drag/ground implant operations however, certain release conditions must be maintained in order to assure the proper functioning of the munition and fuze system.

Note

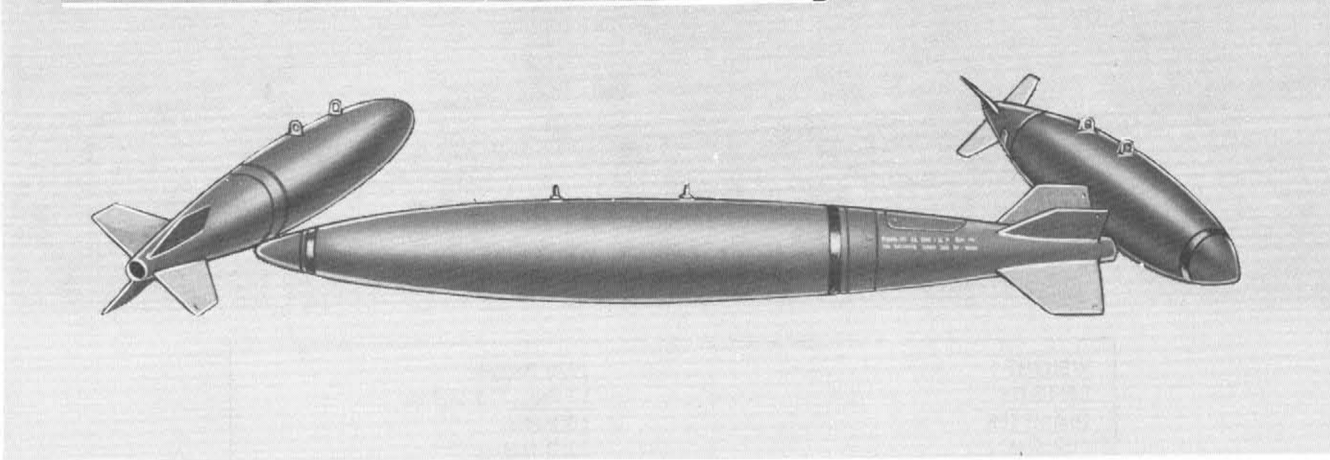
For low drag/destructor employment, information is available in T.O. 1F-4C-34-1-1A, sections V and VI, regarding optimum release parameters.

MK82, MK83, MK84 LDGP BOMBS

The 80-series low-drag, general-purpose (LDGP) bombs are illustrated in figures 1-78 thru 1-80. The bombs are similar in shape, explosive used, and construction; they vary in weight and size. The high-explosive filler used in the bombs is Tritonal 80-20. The external shape of the bombs is designed to produce a minimum drag within the speed ranges of the aircraft. The following list defines the quantity of explosive contained in each bomb.

Bomb	Explosive Wt.
MK 82	192 Lbs.
MK 83	445 Lbs.
MK 84	945 Lbs.

MK 82 LOW DRAG GP BOMB

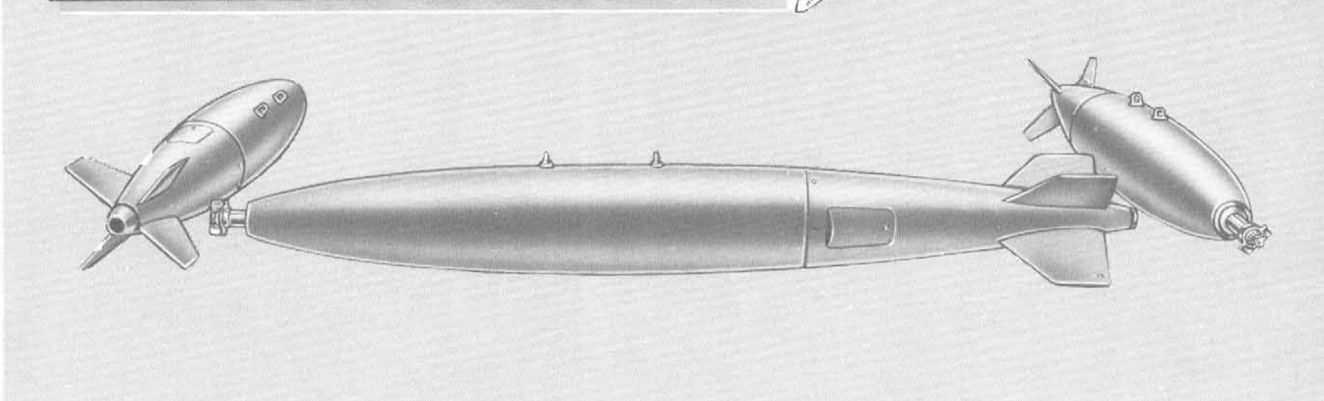


BOMB DRAG INDEX	1.1
WEIGHT	531 Pounds
LENGTH	7 Ft., 3 Inches
DIAMETER	10.8 Inches
FIN SPAN	15 Inches
FUZE	Refer to Bomb/Fuze Compatability
FLIGHT LIMITATION:	Refer to Flight Manual

F4-34-1-455

Figure 1-78

MK 83 LOW DRAG GP BOMB

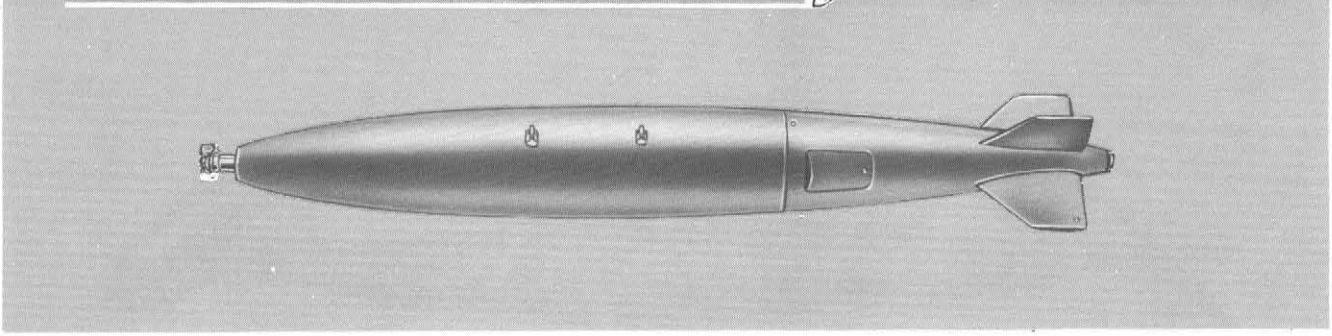


BOMB DRAG NUMBER	1.8
WEIGHT	985 Pounds
LENGTH	9 Ft., 10.5 Inches
DIAMETER	14 Inches
FIN SPAN	19.6 Inches
FUZE :	Refer to Bomb/Fuze Compatibility
FLIGHT LIMITATIONS :	Refer to Flight Manual

F4-34-1-456

Figure 1-79

MK 84 LOW DRAG G P BOMB



WEIGHT	1970 Pounds
LENGTH	12 Ft., 7.5 Inches
DIAMETER	18 Inches
FIN SPAN	25.3 Inches
SUSPENSION LUGS	30 Inches
FUZE	Refer to Bomb/Fuze Compatibility
FLIGHT LIMITATIONS	Refer to Flight Manual

4C-34-1-1-(81)

Figure 1-80

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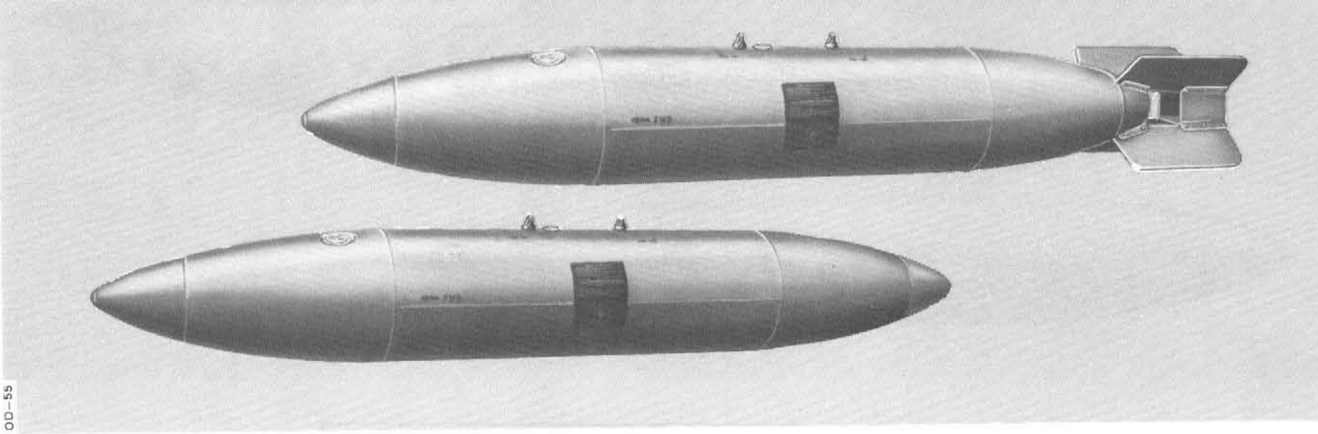
BLU-1/B, B/B, C/B FIRE BOMBS AND BLU-52/B, A/B CHEMICAL BOMBS



WT, EMPTY (Unfinned)	82.5 Pounds
WT, FULL (Unfinned)	697 Pounds
WT. of FIN	15 Pounds
WT of BLU-52/B, A/B	350 Pounds
LENGTH without FIN	11 Ft., 2 Inches
LENGTH with FIN	12 Ft., 4 Inches
DIAMETER:	19 Inches
SUSPENSION LUG DISTANCE:	14 Inches
FLIGHT LIMITS:	Refer to Flight Manual
FIN:	MXU-393/B or MXU-469/B
FUZE:	Refer to Bomb/Fuze Compatibility

Figure 1-82

4C-34-1-1-(83)

BLU-1/B, B/B, C/B FIRE BOMBS

The fire bomb (figure 1-82) is an incendiary munition. The basic structural material is aluminum with a reinforced area below the lugs for sway bracing and forced ejection. An initiator cavity is located between the suspension lugs. The bomb is adapted for use with both nose and tail fuzes and igniters. An igniter cavity, for the igniter/fuze assembly, is located at each end of the bomb beneath the removable nose and tail end caps (figure 1-116). Electrical cables, internally installed in the bomb, electrically connect the initiator and the igniter fuzes.

Operation of the bomb commences as it is force-ejected from the MER or TER by extracting the arming lanyard from the initiator, the arming lanyard is

BLU-27/B, A/B FIRE BOMBS

WT, EMPTY (Unfinned)	110 Pounds
WT, FULL (Unfinned) BLU-27/B	832 Pounds
BLU-27A/B	800 Pounds
WT. of FIN	15 Pounds
LENGTH without FIN.	11 Ft., 2 Inches
LENGTH with FIN	12 Ft., 4 Inches
DIAMETER:	19 Inches
SUSPENSION LUG DISTANCE	14 Inches
FLIGHT LIMITS:	Refer to Flight Manual
FIN:	MXU-393/B or MXU-469/B.
FUZE:	Refer to Bomb/Fuze Compatibility

4C-34-1-1-(84)

Figure 1-83

retained by the arming solenoid. This permits a firing pin to fire a thermal battery and electrically arm the fuze. The fuzes function upon impact to burst the igniter. The white phosphorus igniter causes immediate ignition of the splattered fuel from the required bomb. Typical fuze network for the fire bomb is illustrated in figure 1-116.

Due to structural weakness of the end cap supports attached to the nose and tail assembly, the end caps can be expected to separate from the bomb during falling and tumbling after it is released. This structural weakness of the cap supports has been corrected in later production bombs.

BLU-1/B, B/B FIRE BOMBS

The BLU-1/B is identical to the BLU-1B/B except the BLU-1B/B has an initiator adapter nut over the initiator cavity and has higher suspension lugs.

BLU-1C/B FIRE BOMB

The BLU-1C/B fire bomb is identical to the BLU-1B/B fire bomb except that the rear bulkhead has been reversed so that option of using an end cap or a fin assembly on the tail of the BLC-1C/B is available after the bomb is filled. The BLU-1B/B does not have this option after the bomb is filled.

BLU-27/B, A/B FIRE BOMBS

The BLU-27/B and A/B fire bomb (figure 1-83) is a BLU-1B/B fire bomb that has been welded at the seams and loaded at the factory with Napalm B incendigel mix. Napalm B is a slightly toxic, highly viscous fluid. The BLU-27A/B has external arming wire guides and is colored OD.

BLU-52/B, A/B CHEMICAL BOMBS

The BLU-52/B, A/B bombs (figure 1-82) consist of the shell of the BLU-1C/B fire bomb, filled with a white chemical powder. The BLU-52/B is prefilled with CS-1 chemical agent and the BLU-52A/B is prefilled with CS-2 chemical agent. The bombs are designed for external carriage on high performance aircraft with forced ejection release systems but can be released from low speed aircraft. When employed with CS-1 or CS-2 filling, the bomb is equipped with a tail fin and does not use a fuze or initiator. The weight of the bomb varies with humidity and degree of packing.

FIRE/CHEMICAL BOMB FIN ASSEMBLIES

The MXU-393/B or MXU-469/B fin assembly is designed for use with the BLU-1/B, B/B, C/B, -27/B, A/B fire bombs; and the BLU-52/B, A/B chemical bombs. The assemblies, which stabilize the bombs in flight, are made of aluminum and consist of four fin blades and a supporting structure. The fin assemblies are interchangeable and produce the same trajectory. Bomb length is increased approximately 14 inches when a fin assembly is attached.

SUU-7 DISPENSERS

CBU-1, -2, SERIES WEAPONS

The CBU (Cluster Bomb Unit) weapon consists of the SUU-7 (suspension and release unit) dispenser and the BLU (Bomb, Live Unit) series bomblets. The SUU-7 dispensers (figure 1-84) are cylindrical in shape with a hemispherical nose and conical tail assembly. Nineteen thin aluminum tubes are shaped at the tail end to fit the conical contour of the tail assembly.

CAUTION

- All SUU-7 series dispensers must be modified with a ballast band to provide release capability of the empty dispenser. The ballast band is added to change the center of gravity (CG) location of the empty dispenser. This is necessary to prevent the ejection force from causing the empty dispenser to rotate upward and collide with the aircraft.
- Tube extensions are required on the CBU-1 and CBU-2 series dispensers at all stations of the F-4C/D/E aircraft.

Note

- Only the CBU-2C/A (SUU-7C/A dispenser) has an internal ballast band. The ballistics data, description, and procedures applicable to CBU-2B/A is also applicable to CBU-2C/A.
- When dispensing the CBU-46/A from the center line, the retainer cups may strike the under side of the aircraft, causing superficial damage. This should not limit the operational use of this munition.

Ram-air through the opening in the nose dispenses the BLU bomblets. The bomblets are retained in the SUU-7 dispensers by means of an explosive detent which fits into a keyway in the tube retaining plug. This plug is the last item loaded in each tube. A spring (unattached) and a piston (unattached) are loaded at the forward end of each tube, ahead of the bomblets. When the aircraft release circuitry fires the explosive detent, this spring overcomes initial tube-load inertia and starts the train of bomblets moving rearward. Ram air pressure from the nose of the dispenser acts on the piston to complete the ejection sequence. Refer to figure 1-84 CBU components.

A panel on the forward upper section of the SUU-7 series may be removed to expose the tube selection cannon plugs. Mating of these connections permits tube sequencing to be selected. Early SUU-7 series dispensers have 1-, 2- and 3- tube options, while later dispensers are designed to permit 2-, 4-, and 6- tube options, and are identified as the SUU-7B/A (CBU-2B/A) or SUU-7C/A (CBU-2C/A). Refer to figure 1-84 for tube selection, identification and firing sequence. This selection of tube option determines the number of tubes which will be activated with each release signal. The CBU harness should never be connected except in an authorized arming area. The ROCKET - CBU switch on the MER's and TER's must be on CBU when CBU's are loaded. The SUU-7A/A dispenser has anodized aluminum tubes.

The CBU-1A/A is an anti-personnel weapon, consisting of the SUU-7A/A dispenser loaded with BLU-4/B bomblets. For further details on this munition, see T.O. 11A1-5-6-51. The CBU series is a weapon designed for use against personnel or light material targets. The CBU-2/A consists of the SUU-7/A dispenser loaded with 360 (17 tubes) BLU-3/B bomblets. The CBU-2A/A consists of the SUU-7A/A dispenser loaded with 406 BLU-3/B bomblets (19 tubes).

Note

Refer to the secret supplement (T.O. 1F-4C-34-1-1B) for a description of the BLU-3/B and associated information.

CBU-46/A DISPENSER AND BOMB

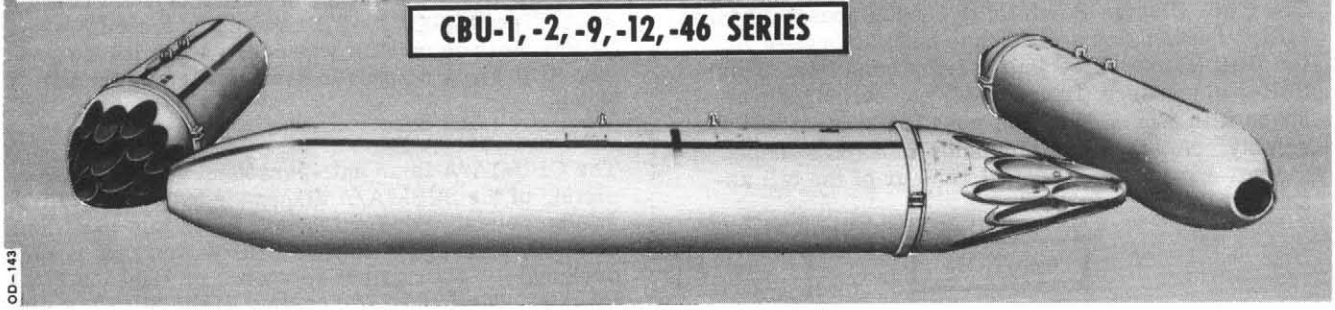
The CBU-46/A consists of 444 BLU-66/B antipersonnel bombs packaged in a SUU-7C/A bomb dispenser (figure 1-84). The SUU-7C/A dispenser is cylindrical with conical nose and tail sections, and has 19 thin walled aluminum tubes shaped at the tail end to fit the conical contour of the tail assembly. The dispenser has an internal ballast band required for dispenser stability when jettisoned. (Only 18 of the 19 tubes in the CBU-46/A are loaded. The center tube, tube K, is empty.) The conical nose cone has an opening to allow ram air to dispense the bombs. The bombs are retained in the dispenser by an explosive detent which fits into a keyway in the tube retaining plug. This plug is the last item loaded into each tube. A spring (unattached) and a piston (unattached) are loaded at the forward end of each tube, ahead of the bombs. When the aircraft release circuitry fires the explosive detent, the spring overcomes initial tube load inertia and starts the train of bombs moving. Ram-air pressure from the nose of the dispenser acts on the piston to complete the ejection sequence. Tubes may be ejected in a two-tube, four-tube, six-tube, or salvo release. This option is made by rotating the manual selector switch with a screwdriver to the desired position before or after the dispenser is attached to the aircraft. The MER switch is positioned to CBU.

BLU-66/B Bomb

The BLU-66/B is an antipersonnel bomb, 2.8 inches in diameter, 3.7 inches long, and weighs 1.5 pounds. The bomb consists of a spherical fragmenting case, a plastic impeller vane with a 2.2 inch diameter obturating disc, and a spin arm/spin decay fuze that allows the bomb to penetrate a jungle canopy prior to detonation. Upon release from the dispenser, the

SUU-7A/A, B/A, C/A DISPENSERS

CBU-1, -2, -9, -12, -46 SERIES



LENGTH . . . . 9 Ft., 10.4 Inches
DIAMETER . . . . 15.62 Inches
FLIGHT LIMIT . . . . Refer to T.O. 1F-4C-1

* CBU-1A/A: SUU-7A/A Dispenser with BLU-4A/B Bombs
19 tubes filled with 509 bombs.
Loaded wt: 782 lbs. Empty wt: 151 lbs.

* CBU-2/A: SUU-7A/A Dispenser with BLU-3/B Bombs.
17 tubes filled with 360 bombs.
Loaded wt: 779 lbs. Empty wt: 151 lbs.

* CBU-2A/A: SUU-7A/A Dispenser with BLU-3/B Bombs.
19 tubes filled with 406 bombs.
Loaded wt: 858 lbs. Empty wt: 151 lbs.

* CBU-2B/A: SUU-7B/A Dispenser with BLU-3/B Bombs.
19 tubes filled with 409 bombs.
Loaded wt: 870 lbs. Empty wt: 158 lbs.

* CBU-2C/A: SUU-7C/A Dispenser with BLU-3/B Bombs.
19 tubes filled with 409 bombs.
Loaded wt: 870 lbs. Empty wt: 158 lbs.

CBU-9/A: SUU-7A/A Dispenser with BDU-28/B Bombs.
19 tubes filled with 409 practice bombs.
Loaded wt: 688 lbs. Empty wt: 158 lbs.

CBU-9A/A: SUU-7B/A Dispenser with BDU-28/B Bombs.
19 tubes filled with 409 practice bombs.
Loaded wt: 688 lbs. Empty wt: 158 lbs.

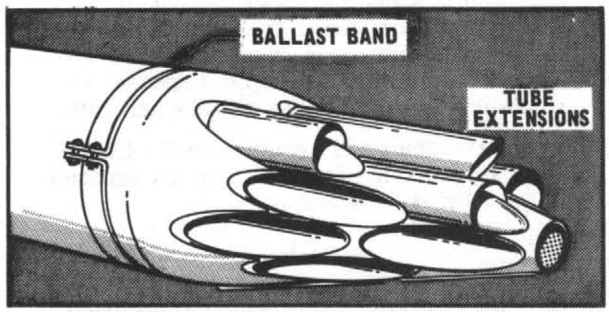
CBU-9B/A: SUU-7C/A Dispenser with BDU-28/B Bombs.
19 tubes filled with 409 practice bombs.
Loaded wt: 688 lbs. Empty wt: 158 lbs.

CBU-12/A: SUU-7B/A Dispenser with BLU-17/B Bombs.
16 tubes filled with 213 smoke bombs (Tubes A, B and C are empty).
Loaded wt: 650 lbs. Empty wt: 158 lbs.

CBU-12A/A: SUU-7C/A Dispenser with BLU-17/B Bombs. 16 tubes filled with 213 smoke bombs (Tubes A, B and C are empty). Loaded wt: 687 lbs. Empty wt: 158 lbs.

CBU-46/A: SUU-7C/A Dispenser with BLU-66/B Bombs
18 tubes filled with 444 bombs(Tube K is empty)
Loaded wt: 890 lbs. Empty wt: 158 lbs.

* Tube extensions are required on all stations.



WARNING

The dispenser must be modified with a ballast band to permit release of the empty dispenser. The weight of the ballast band (30 lbs.) is included in the above weights, (T.O. 11A-155-127).

Note

The SUU-7C/A has an internal ballast band.

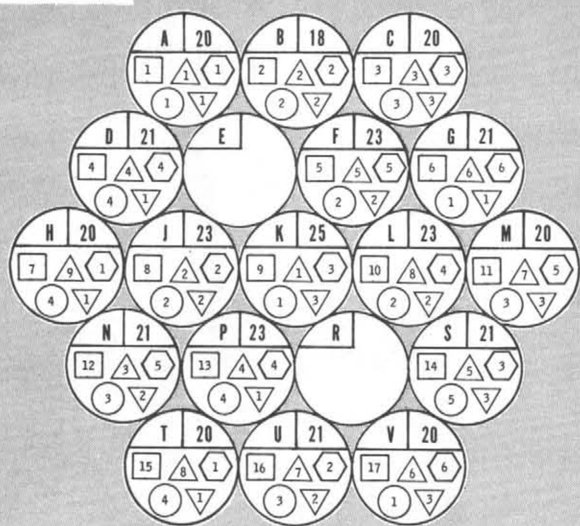
4C-34-1-1-(85-1)

Figure 1-84 (Sheet 1 of 4)

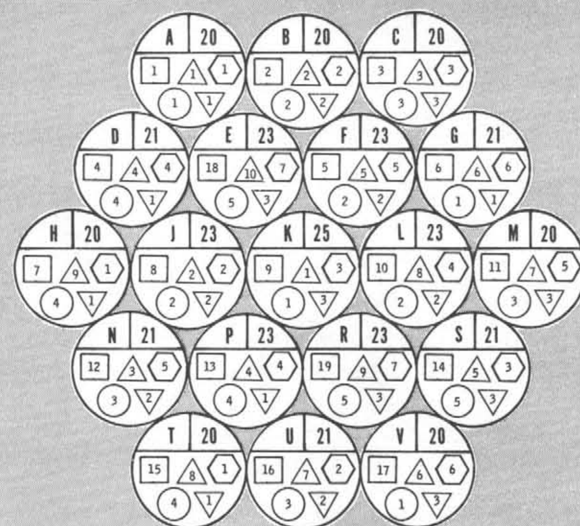
FIRING OPTIONS

CBU-2/A AND CBU-2A/A FIRING OPTIONS

CBU-2/A

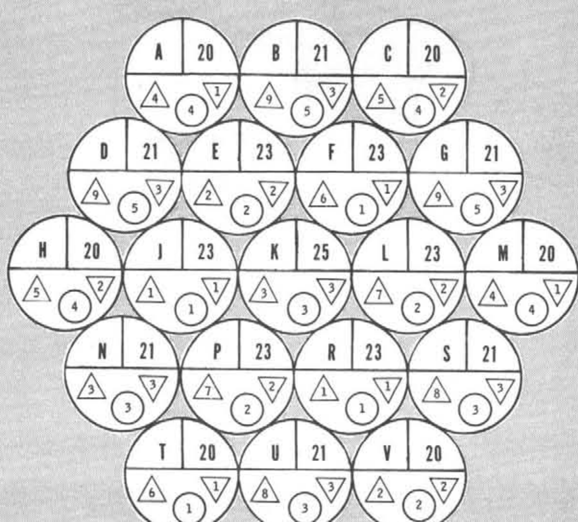


CBU-2A/A



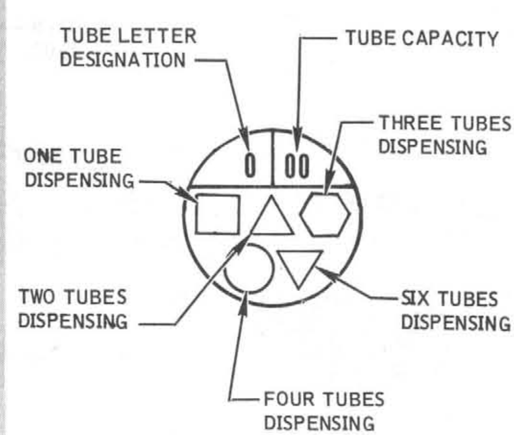
FIRING OPTIONS

CBU-2B/A AND CBU-2C/A



SYMBOL EXPLATIONS

SYMBOL EXPLATION



Note

BOTH THE CBU-2/A AND CBU-2A/A HAVE A SALVO CAPABILITY

F4-34-1-462-2

Figure 1-84 (Sheet 2 of 4)

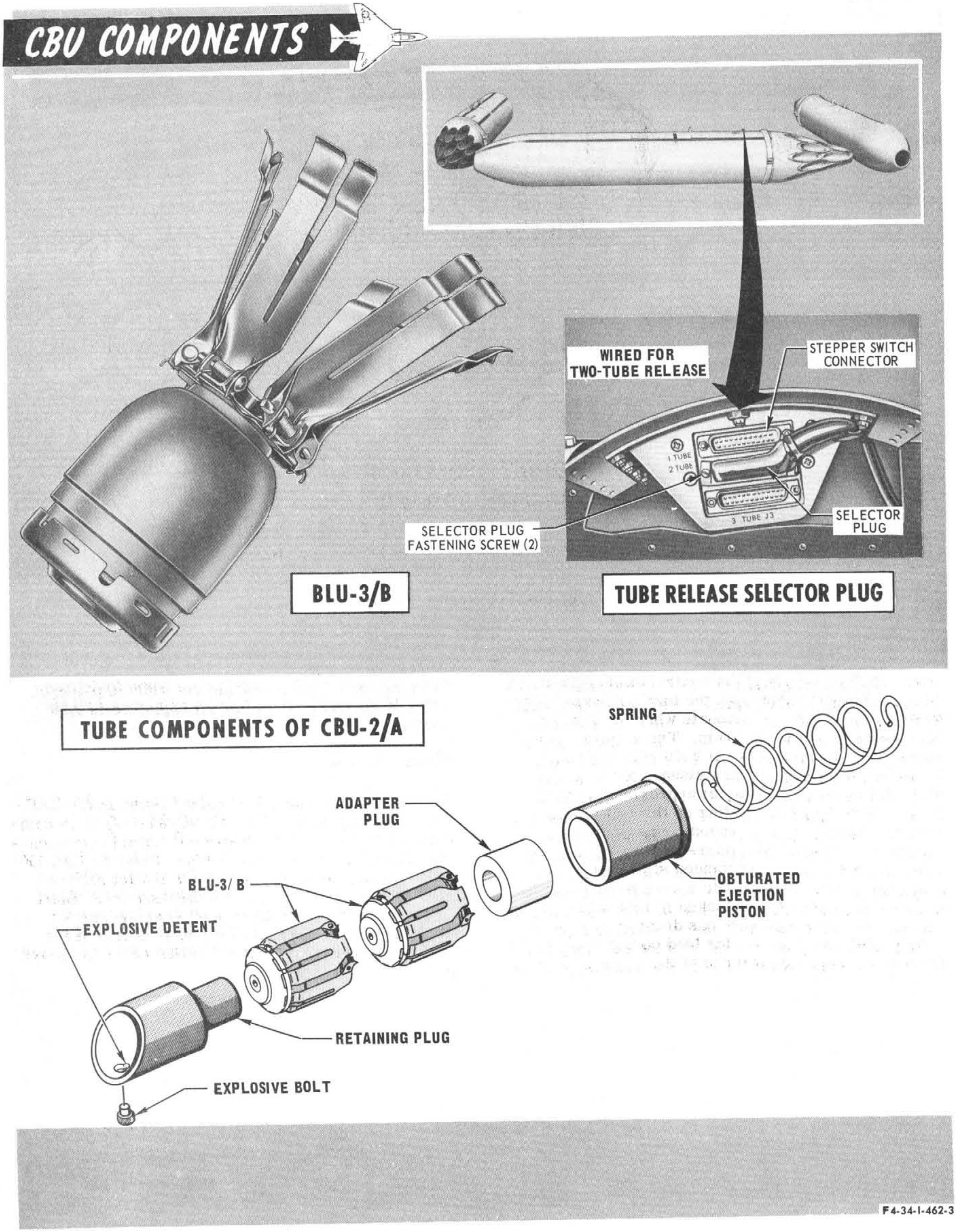
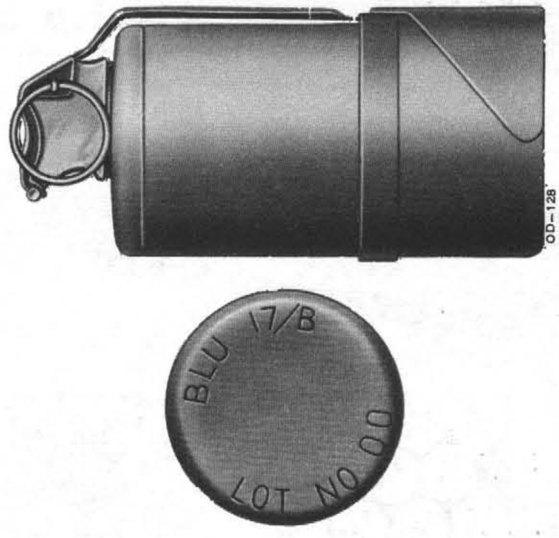


Figure 1-84 (Sheet 3 of 4)



BLU-17/B SMOKE BOMB
Used with CBU-12/A, A/A Dispensers

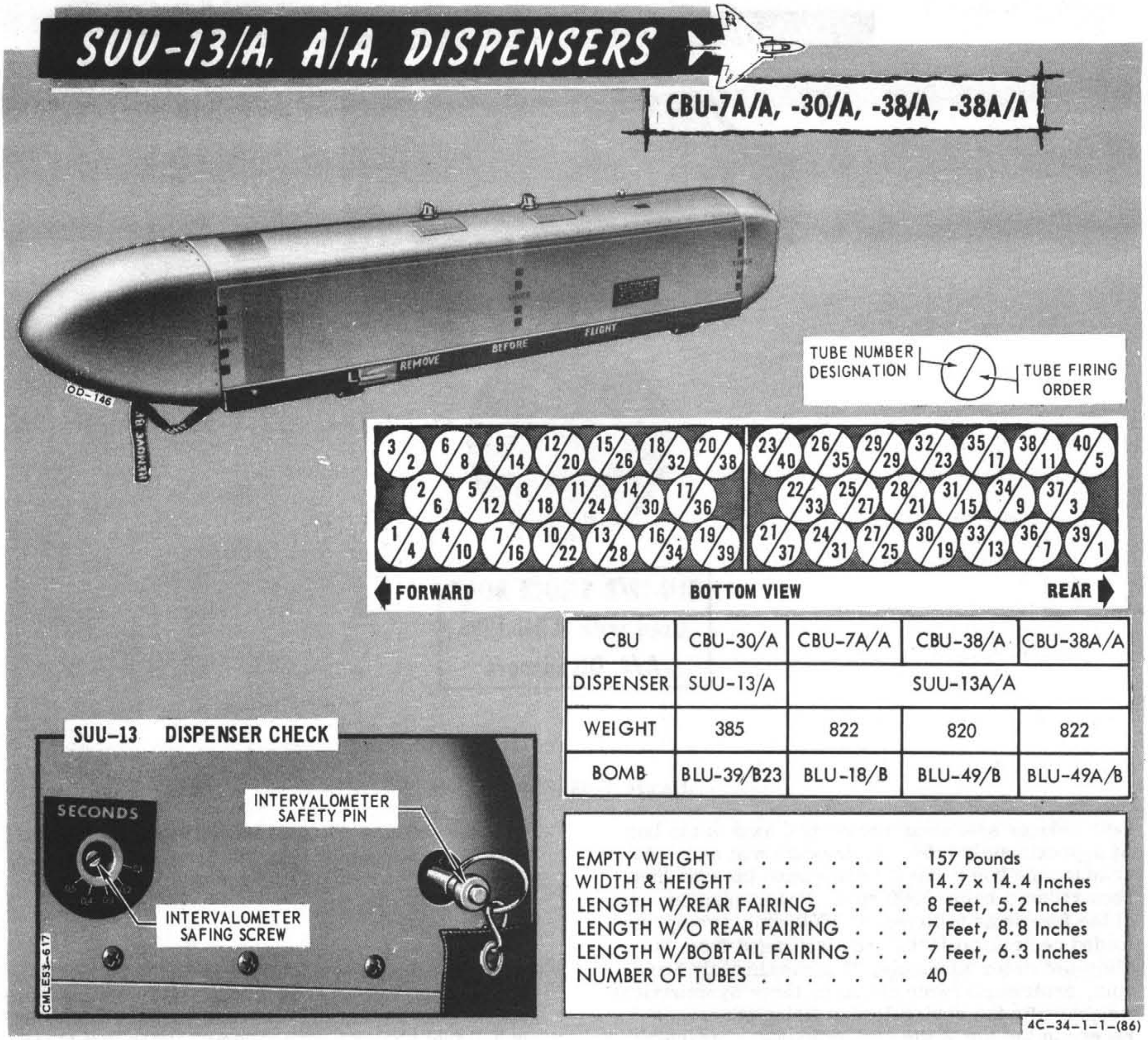
4C-34-1-1-(85-4)

Figure 1-84 (Sheet 4 of 4)

vane induces spin about the central axis oi the bomb. At approximately 3500 rpm the fuze will arm. After arming, the bomb will detonate when the spin has been reduced below 2000 rpm. The arming sequence of the fuze is as follows: At 2500 rpm, two spring loaded centrifugal locks are disengaged from the slide-detonator assembly, at approximately 3500 rpm, centrifugal force acting on three symmetrical weights lifts the spring-loaded firing pin from a recess in the top of the slider-detonator assembly. This action frees the unbalanced slider-detonator assembly which centrifugally moves the detonator in line. The detonator is locked in line with a spring detent. When the spin rate has decayed to approximately 2000 rpm, the spring load on the firing pin exceeds the centrifugal force of the weights, and the firing pin is released causing the bomb to detonate. The total weight of the Cyclotol explosive is 0.26 pound.

Planning Data

The sight depression angle values listed in the CBU-46/A bombing tables (T.O. 1F-4C-34-1-2) were computed to provide initial BLU-66/B impacts commencing 750 feet short of the aimpoint. Refer to T.O. 1F-4C-34-1-1A, section I, part 4 for impact pattern dimensional information. A deflection error chart (section VI, this manual) is used to determine the deflection error induced by the spin motion of the bomb after release. This deflection error is always to the left.



CBU	CBU-30/A	CBU-7A/A	CBU-38/A	CBU-38A/A
DISPENSER	SUU-13/A	SUU-13A/A		
WEIGHT	385	822	820	822
BOMB	BLU-39/B23	BLU-18/B	BLU-49/B	BLU-49A/B

EMPTY WEIGHT	157 Pounds
WIDTH & HEIGHT	14.7 x 14.4 Inches
LENGTH W/REAR FAIRING	8 Feet, 5.2 Inches
LENGTH W/O REAR FAIRING	7 Feet, 8.8 Inches
LENGTH W/BOBTAIL FAIRING	7 Feet, 6.3 Inches
NUMBER OF TUBES	40

Figure 1-85

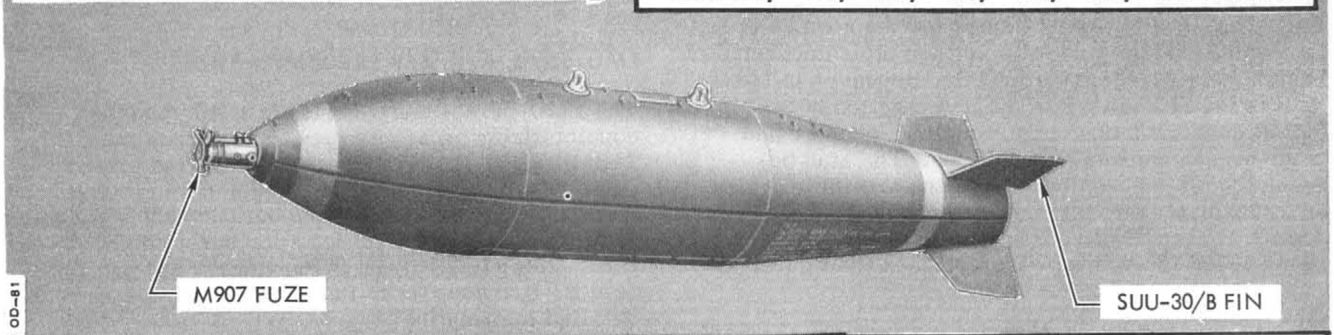
CBU-12/A, A/A DISPENSERS AND BOMBS

The CBU-12/A smoke producing weapon (1-84) consists of the SUU-7B/A dispenser and the BLU-17/B smoke bomb. The CBU-12A/A consists of the SUU-7C/A dispenser and BLU-17/B smoke bombs. The SUU-7B/A dispenser is cylindrical in shape with a round nose and conical tail. (See CBU-2B/A descriptive data.) The CBU-12/A, A/A carries 213 BLU-17/B smoke bombs which discharge white phosphorus (WP) into the atmosphere when the burster charge functions. The top three tubes (A, B, and C) are not loaded. The BLU-17/B smoke bomb will discharge white phosphorus (WP) over a 105-foot radius.

R.H.

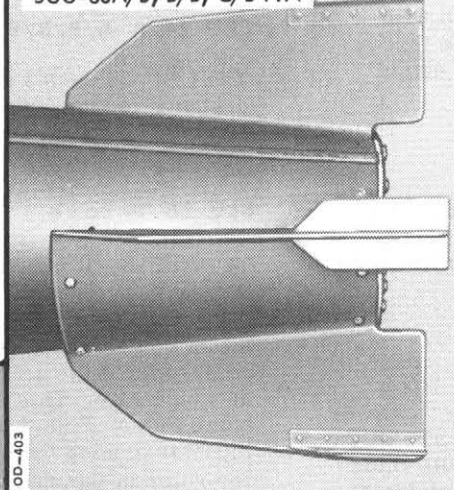
SUU-30 DISPENSERS

CBU-24, -29, -49, -52, -58, -70, -71 SERIES



BLU-26/B, -36/B, -59/B, -61A/B -63/B BOMB

SUU-30A/B, B/B, C/B FIN



SUU-	CBU-	BLU-	QUANTITY PAYLOAD
30/B	24/B 29/B 49/B	26/B 36/B 59/B	665
30A/B	24A/B 29A/B 49A/B	26/B 36/B 59/B	665
30B/B	24B/B 29B/B 49B/B 52A/B 70/B	26/B 36/B 59/B 61A/B 85/B	665 217 79
30C/B	24C/B 29C/B 49C/B	26/B 36/B 59/B	665
30H/B	52B/B 58/B 71/B	61A/B 63/B 86/B	217 650 650

LENGTH	7 Ft. 6 Inches
DIAMETER	16.0 Inches
SUSPENSION LUG DISTANCE	14.0 Inches
FLIGHT LIMITS	Refer to Flight Manual
FUZE	Refer to Bomb/Fuze Compatability

4C-34-1-1-(87)

Figure 1-86

SUU-30 DISPENSERS

SUU-30/B DISPENSER

The SUU-30/B dispenser is divided in half longitudinally. The upper half contains the strongback section; the lower half contains a reinforced hardshell area for reinforcement while stored on chocks. The dispenser skin is of low alloy, high strength steel. The two halves are locked together by a nose locking cap at the forward end and by a base plate screwed into both halves at the aft end. Two MK 6 Mod 0 lugs (14-inch suspension) are mounted on metal rods which extend through the dispensers and attach to the bottom half. A dual set of external arming wire guides is positioned along the top half to prevent excess arming wire vibration and to route the arming wire around the MER/TER ejector foot. Two identical dual-fin attachments are located on the aft end of the dispenser body. The fins are canted 2-1/2° to impart spin to the dispenser when released from the aircraft. The wrought aluminum alloy fins are mounted in (x) configuration. The M907 mechanical time fuze is used.

SUU-30A/B DISPENSER

The SUU-30A/B dispenser is basically a SUU-30/B dispenser which has been modified to eliminate the tension members and to incorporate a fin assembly modification to provide improved aerodynamics. Specific changes are removal of the fin cant, increased chord length, and the addition of tip plates: the fin span is not changed. Two MAU-76/A lugs are used for suspension. The basic dispenser function is not affected by these modifications. The M907 mechanical time fuze is used.

SUU-30B/B DISPENSER

The SUU-30B/B is constructed to accommodate the M907 fuze, the FMU-56/B, A/B, B/B fuze, and the FMU-26A/B, B/B fuze. Except for the nose section and the installation of a lanyard attachment stud behind the aft suspension lug, the dispenser is identical to the SUU-30A/B. The nose section of SUU-30B/B contains a nose cap, coupling, adapter and plug, breech cap and lanyard tube. The stud between the aft suspension lug and the tail fin provides an attachment point for lanyards used with FMU-26A/B, B/B and FMU-56/B, A/B, B/B fuze. Refer to figure 1-106 for Arming Wire/Lanyard Configuration.

Note

> The M907 fuze is physically compatible with the SUU-30B/B dispenser, however the fuze is unreliable with the SUU-30B/B and should not be used.

SUU-30C/B DISPENSER

The SUU-30C/B dispenser is identical to the SUU-30A/B except for the internal reinforcing rings to support the hard backs. The M907 mechanical time fuze is used.

SUU-30 H/B DISPENSER (CBU-58B)

The CBU-58/B consists of the SUU-30H/B dispenser and approximately 650 BLU-63/B bombs. The SUU-30H/B dispenser is identical to the SUU-30B/B dispenser (figure 1-86) except that the fin tip plates are 1.50 inches shorter and are attached vertically on the trailing edge of the fin. The BLU-63/B has approximately the same size, weight, external appearance, and uses the same fuze, booster pellet, and explosive as the BLU-26/B. Functional characteristics of the CBU-58/BLU-63 are therefore similar to those of the CBU-24/BLU-26.

M907 MECHANICAL TIME FUZE

The M907 nose fuze (figure 1-108) is an air-armed, air-burst, mechanical time fuze with a black powder booster. The M907 fuze is attached to the dispenser nose locking ring. Fuze function times are from 4 to 92 seconds and are set prior to flight. The fuze has an air-burst functioning accuracy of ± 1 second over a temperature range of -65°F to +160°F. Refer to Bomb Fuzes for a detailed description of the M907 fuze.

FMU-26A/B, -26B/B ELECTRIC TIME FUZE

The FMU-26A/B (figure 1-110) FMU-26B/B (figure 1-111) bomb fuze is an electronically timed fuze that may be used on the CBU-24B/B, CBU-29B/B or CBU-49B/B. The fuze is cylindrically shaped and fits into the fuze well in the nose of the munition. Delay settings on the fuze provide a selection of operating modes. External components of the fuze consist of a housing, cover plate, safing plug, safe-pin assembly, seal pin, and booster. The safing plug is replaced by a battery firing device when the fuze is installed in a munition and prepared for use.

FMU-56/B, A/B, B/B PROXIMITY FUZES

The FMU-56/B (figure 1-114) is a self-powered doppler radar proximity fuze used to open the CBU-24B/B, -29B/B, -49B/B at a preselected altitude AGL. The fuze has nine adjustable arming times from 2 to 18 seconds and nine burst height settings. Refer to T.O. 1F-4C-34-1-1A for burst height settings. Refer to FMU-56/B Proximity Fuze and FMU-56A/B, B/B Proximity Fuze, this part, for more detailed information.

CBU-24/B, A/B, B/B, C/B DISPENSERS AND BOMBS

The CBU-24 series contains the BLU-26/B bomb, designed for use against personnel and light material targets. See figure 1-86 for SUU-30 designation.

BLU-26/B Bomb

The BLU-26/B is contained in the CBU-24 series dispensers. The BLU-26/B bomb (figure 1-86) is a spin armed, self-dispersing, fragmentation submunition that detonates upon impact. When the bomb is released into the air stream, the bomb begins to spin at a high rate. This spinning action is caused by the bomb flutes. Spinning enhances bomb dispersion and initiates arming the M219 fuze. The weights that hold the rotor in the unarmed position are released by the centrifugal force of the spinning bomb. As the hammer weights move back, the firing pin is released from the rotor. Disengagement of the weights which hold the rotor in the unarmed position allows the rotor to arm. The M219 fuze is sensitive to impact from any direction. Impact with a target detonates the high-explosive filler which bursts the bomb case and propels the steel balls at high velocity in a radial direction.

Note

> Since certain fuzing and arming criteria must be met, it is necessary to carefully preplan and execute any mission involving the delivery of the CBU-24/B, A/B, B/B, C/B. To assure adequate time for the bomblet (submunition) to spin-up and arm, do not select burst heights' lower than those presented in the bombing tables (T.O. 1F-4C-34-1-2) for various reconditions.

CBU-29/B, A/B, B/B, C/B DISPENSERS AND BOMBS

The CBU-29 series contains the BLU-36/B bomb, designed for use against personnel and light material targets. See figure 1-86 for SUU-30 dispenser designation. See T.O. 1F-4C-34-1-1A for the delay time of the random detonating fuze of the BLU-36/B bomb.

BLU-36/B Bomb

With the exception of bomb fuzing, the CBU-29 and CBU-24 series munitions are identical. The BLU-36/B bomb used with the CBU-29/B, A/B, B/B, C/B is equipped with an M218 time delay fuze which detonates randomly after impact. Refer to T.O. 1F-4C-34-1-1A for M218 delay time.

CBU-49/B, A/B, B/B, C/B DISPENSER & BOMB

The CBU-49 series contains the BLU-59/B bomb. See figure 1-86 for SUU-30 dispenser designation.

BLU-59/B Bomb

The BLU-59/B is contained in the CBU-49 series dispensers. With the exception of bomb fuzing, the BLU-59/B and the BLU-26/B are identical. The BLU-59/B bomb is equipped with an M224 time delay fuze which detonates randomly after impact. The time period for all M224 fuzes to detonate is substantially less than the BLU-36/B.

CBU-52A/B DISPENSER & BOMB

The CBU-52A/B consists of the SUU-30B/B dispenser (figure 1-86) and 217 BLU-61A/B bombs. The functional sequence is identical to the CBU-24B/B system.

CBU-52B/B DISPENSER AND BOMB

The CBU-52B/B consists of the SUU-30H/B dispenser and 217 BLU-61A/B bombs. The functional sequence of the CBU-52B/B is identical of that sequence for the CBU-24B/B and CBU-52A/B munition systems.

BLU-61A/B Bomb

The BLU-61A/B is a 3.3 inch diameter, self-dispersing, spherical, high explosive/fragmentation bomb which is designed for use against materiel targets. The bomb contains a zirconium liner to provide an incendiary capability and employs the M219 fuze. Ballistic tables and impact pattern data are provided in T.O. 1F-4C-34-1-2.

CBU-71/B DISPENSER AND BOMB

The CBU-71/B dispenser and bomb consists of the SUU-30H/B dispenser loaded with approximately 650 BLU-86/B fragmentation bombs.

BLU-86/B Bomb

With the exception of bomb fuzing, the BLU-86/B and BLU-63/B bombs are identical. The BLU-86/B bomb is equipped with a M224 time delay fuze which detonates at random times after impact.

CBU-70/B DISPENSER AND BOMB

The CBU-70/B consists of the SUU-30B/B dispenser and 79 BLU-85/B multiple linear shaped charge (MLSC) submunitions. The FMU-26 or FMU-56 series fuzes may be used to function the dispenser at the preset time after release or altitude above ground.

BLU-85/B Bomb

The BLU-85/B weighs approximately 5.8 pounds and is 2.5 inches in diameter. The major components of the BLU-85/B include a BLU-49/B fuze, and MLSC warhead, a stabilizing ribbon and a stabilizing ribbon housing with composition B explosive filler in the warhead.

SUU-13 DISPENSERS

CAUTION

Refer to Rehoming MERS and TERS, part 1, 2, or 3.

SUU-13/A DISPENSER

The bomb packages are ejected from the SUU-13/A dispenser when the bomb button is depressed. Depressing the bomb button supplies power to fire an electrically primed cartridge of one cylinder and activates a stepping mechanism and a control intervalometer which continues to stepfire one tube at a time until the bomb button is released. The pulse rate (time spacing between tube firings) is controlled by a timing circuit. The rate of stepping is preset on the ground by a selector switch in the dispenser control box. The available pulse rates are 100, 200, 300, 400, and 500 milliseconds.

Only the RKTS & DISP/SINGLE mode can be used to release the bomb packages from the SUU-13/A dispenser. The release signal must be continuously applied to the SUU-13/A timing circuit for a time duration (4 to 19 seconds) determined by the dispenser pulse rate setting: multiply the pulse rate setting by 39. However, the amber station select light will normally go out when all dispensers on that station have timed out. The bomb release button must be released to cause the stepper switch in the MER/TER to transfer to the next dispenser. When the bomb button is released, stepping will occur even if the previous dispenser is partially expended. The MER and TER switch must be set on CBU.

The dispenser payloads are contained in the SUU-13/A in a sealed cylinder assembly which also contains the explusion cartridge. The expulsion cartridge is located within a high-pressure chamber. The gas produced when the cartridge is fired is directed through a small orifice from this high-pressure chamber to a low-pressure chamber. The reduced pressure limits the reaction on the dispenser.

SUU-13A/A DISPENSER

The primary difference between the SUU-13/A and SUU-13A/A is the available pulse rates. The SUU-13A/A available pulse rates are: 50, 100, 200, 300, and 400.

CBU-7A/A DISPENSER & BOMB

The CBU-7A/A weapon consists of the SUU-13A/A downward ejection dispenser and BLU-18/B anti-personnel bomb packages and bombs. Refer to figure 1-85.

The SUU-13A/A dispenser is constructed of high-strength aluminum. The dispenser has a flat open bottom, flat sides, a curved hardback section and 14-inch suspension lugs. The loaded SUU-13A/A dispenser contains 40 tubes with 30 BLU-18/B bombs contained in each bomb package per loaded tube for a total of 1200 BLU-18/B bombs per dispenser.

The dispenser payloads (BLU-18/B packages) are contained in the SUU-13A/A in a sealed cylinder assembly which also contains the expulsion cartridge. The expulsion cartridge is a high-pressure chamber. The gas produced when the cartridge is fired is directed through a small orifice from this high-pressure chamber to a low-pressure chamber. The reduced pressure limits the reaction on the dispenser and produces a payload ejection velocity of approximately 65 fps. Refer to the classified supplement to this manual for additional information on this munition.

Pattern Length

The CBU-7A/A Ripple Release tables list the total impact pattern length for a 40-bomb (i.e. 40-tube or package ripple) ripple release at the various SUU-13A/A intervalometer settings. The impact pattern length is based on the distance between the mean point of impact for the first and last cluster release. The tabulated sight depression from flight path values assume that the center of the pattern is to be aimed at the target.

CBU-30/A DISPENSER AND BOMB

The CBU-30/A weapon consists of the SUU-13/A downward ejection dispenser and BLU-39/B23 anti-personnel bomb packages and bombs. Refer to figure 1-85.

BLU-39/B23 Bomb Package

A BLU-39/B23 Bomb Package is carried in each of the 40 tubes of the SUU-13/A dispenser. The BLU-39/B23 package contains 32 BLU-39/B23 bomblets. The package is ejected from the tube at approximately 90 fps downward. The package has a fiberglass case with aluminum end plates. A delay element allows the package to burst approximately 0.310 second after it is ejected from the dispenser to release the bomblets. The package is unstabilized in flight.

The BLU-39/B23 package is cylindrically shaped with the following physical characteristics:

Diameter	4.6 in.
Length	10.5 in.
Weight	9.7 lb.

BLU-39/B23 Bomblet

The BLU-39/B23 bomblet has a cylindrical shape and looks very much like a flashlight battery. It has an aluminum case, which contains 40 grams of material (60% pyrotechnic and 40% CS). The bomblet has a delay element so that it will not start to dispense its

CS (smoke) until 5 to 6 seconds after it is released from the cluster. The bomblet dispenses CS for approximately 10 to 15 seconds. When the bomblet impacts on a cleared surface it will skitter about, due to the violent expulsion of the CS smoke from an orifice in one end of the bomblet. The bomblet is unstabilized.

The BLU-39/B23 bomblet has the following physical characteristics:

Diameter	1.25 in.
Length	2.5 in.
Weight	0.13 lb.

Note

Since the bomblet will start to dispense smoke 5 to 6 seconds after release, release conditions which provide a time of flight of less than 6 seconds should be selected.

Pattern Length

With a munition of this type, the impact patterns for a single package are variable. For planning purposes, the size of the impact pattern for a single package is approximately 225 feet in range and 200 feet in deflection. The CBU-30/A Ripple Release tables list the total impact pattern length for a 40-package (bombs per release) release at the various available SUU-13/A intervalometer settings. This impact pattern length is based on the distance between the mean point of impact for the first and last cluster release. The tabulated sight depression from flight path values assume that the center of the pattern is to be aimed at the target.

CBU-38/A, A/A, (SUU-13A/A) DISPENSERS AND BOMBS

The CBU-38/A consist of 40 BLU-49/B bombs respectively, installed in the SUU-13A/A dispenser. The bombs are 4.6 inches in diameter, 10.25 inches long when installed in the SUU-13A/A cylinder, 14 inches long with ringtail extended, and have a nominal weight of 13 pounds. The bombs are ejected downward at approximately 62 fps from the SUU-13A/A when an electric pulse ignites the propellant charge of the ejection cartridge within the cylinders. The resulting pressure buildup is sufficient to shear six pins, which hold the bombs in the cylinder. Three wind tabs within the bomb tail assembly force the stabilizer ringtail into the extended position as the bomb exits. Extension of the tail assembly actuates the fuze system. The bomb arms in 5.5 sec ± 1.0 sec.

Note

For CBU-38/A, release conditions must be selected which provide a BLU-49/B bomb time of flight greater than 6.5 sec for all bombs to assure adequate time for the fuzes to arm prior to impact.

The CBU-38A/A consists of 40 BLU-49A/B bombs installed in the SUU-13A/A dispenser. The BLU-49A/B is identical to the BLU-49/B except for the fuzing. The arming time for the BLU-49A/B was reduced to a minimum of 2.25 seconds and a maximum of 3.50 seconds. The BLU-49A/B has a safety device that prevents the bombs from arming when it senses an impact greater than 25 G after the ringtail has been extended and before the arming time (2.25 to 3.50 sec) is reached. The weight lock was redesigned to prevent it from being misassembled.

Note

For the CBU-38A/A, release conditions must be selected which provide a BLU-49A/B bomb time of flight greater than 3.5 sec for all bombs to assure adequate time for the fuzes to arm prior to impact.

If the bomb must penetrate jungle canopy, the resultant deceleration should not be sufficient to cause the inertial weights to fire the detonator. The bomb then will penetrate and explode following final impact with the ground. Upon water or mud impact (which does not provide sufficient deceleration to fire the detonator by the action of the inertial weights), another means is provided to fire the detonator. Openings in the face of the fuze will allow the fluid media to enter and push a piston against the firing pin. The firing pin then fires the detonator and ignites the explosive train.

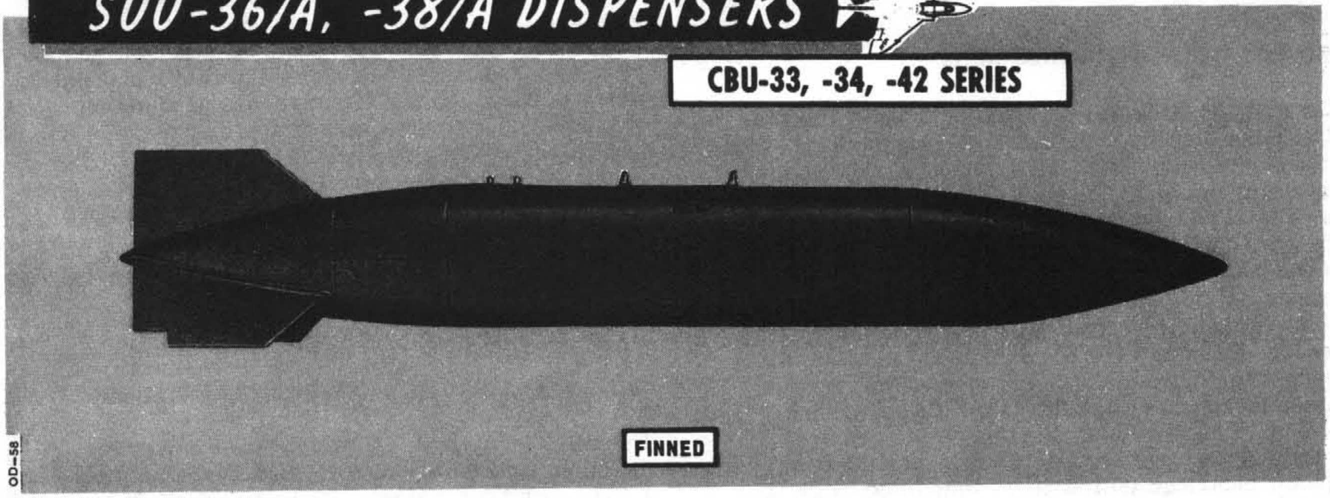
The CBU-38A/A bombing tables are also applicable for the CBU-38/A. However, when releasing the CBU-38/A, release conditions must be selected which will provide a time of flight greater than 6.5 sec. For the dive release conditions, the time of fall of the last bomb must be checked. These values are contained in the bombing tables.

The CBU-38 bombing tables provide data for full dispenser ripple releases at release intervals of 0.05, 0.10, and 0.20 sec. The bomb range listed in the tables represents the horizontal range from initial release to the center of the impact pattern. The impact pattern length listed in the ripple release tables for a 40-bay release represents the distance between the impact points of the first and last bombs released. A fixed dive angle aircraft flight path, throughout the entire ripple release time cycle, was assumed in this computation.

If the CBU-38 is carried on the shoulder positions of either MER or TER, the BLU-49 impact pattern will be displaced laterally in the direction of the side ejection. The magnitude of this lateral displacement, which is induced by an effective lateral munition ejection velocity component of approximately 44 fps (62 x sin 45°), is indicated in the MER/TER Shoulder Position Carriage tables. The quantities listed are measured from the point of ejection and cover the range of release conditions provided in the CBU-38 bombing tables.

SUU-36/A, -38/A DISPENSERS

CBU-33, -34, -42 SERIES



LENGTH, With Tail Fairings removed . . . . 11 Feet, 10 Inches
HEIGHT . . . . 17 Inches
REL. INTERVALS. . . . . (SEE TEXT)

CBU-	SUU-	BLU-	KMU-	WEIGHT		NUMBER OF CANNISTERS
				FULL	EMPTY	
33/A	36/A	45/B	339/B	846	228	10
34/A	38/A	42/B	338/B	902	247	30
34A/A	38/A	42A/B	338/B	902	247	30
42/A	38/A	54/B	338/B	902	247	30

INTERVALOMETER

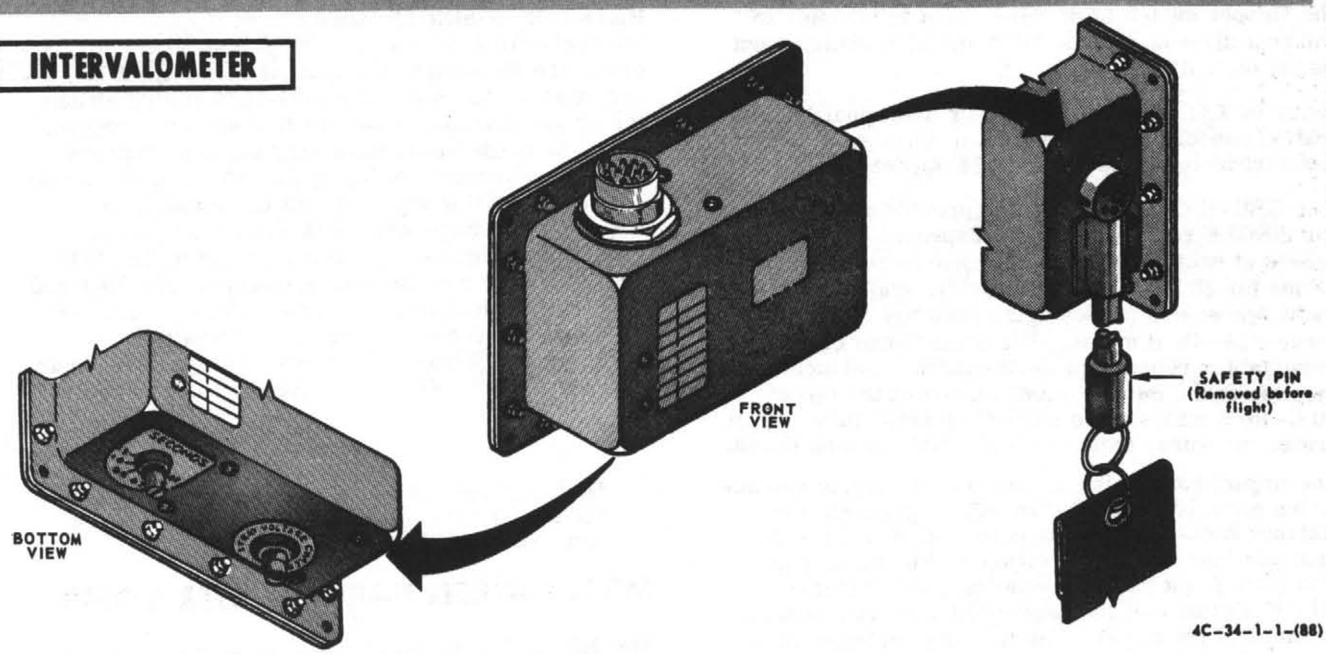


Figure 1-87

SUU-36 DISPENSERS

CBU-33/A DISPENSER AND MINE

The CBU-33/A dispenser and mine consists of the SUU-36/A dispenser (figure 1-87) and the BLU-45/B antivehicle land mine. The CBU-33/A provides the capability of emplacing a subterranean antivehicle mine field from high performance fighter aircraft. The SUU-36/A dispenser has 10 cargo bays, each of which will accommodate three BLU-45/B mines. At release, the dispenser control wiring harness, which is installed in the strongback area of the dispenser, transmits the 28 vdc pulses to initiate the ejector cartridge in each cargo bay. The ejector piston then accelerates the cargo (three stacked BLU-45/B mines) to an ejection velocity of approximately 20 feet per second. The interval between ejector cartridge initiations is controlled by an intervalometer in the right rear frustrum of the dispenser. The available release interval settings are 38, 61, 92, 140, 200, and 300 milliseconds or SINGLE. The desired release interval must be preset before flight.

Note

> The smallest available release interval, 38 milliseconds, is not cleared for use with the BLU-45/B mine cargo.

Only the RKTS & DISP/SINGLE mode can be used to release the canisters from the SUU-36/A dispenser. To empty the dispenser, the release signal must be continuously applied to the SUU-36/A timing circuit for a time duration determined by the dispenser intervalometer setting: multiply the intervalometer setting by 29. The dispenser does not have a CBU monitor circuit to establish an empty or full dispenser. Releasing the bomb release button causes the stepper switch in the MER/TER to transfer to the next dispenser. The MER and TER switch must be set on CBU.

Refer to T.O. 1F-4C-34-1-1A for additional information concerning BLU-45 kill mechanisms, self destruct features, and minefield impact pattern data.

The CBU-33/A bombing tables provide basic data for SINGLE releases and full dispenser ripple releases at each permissible release interval. The tables for SINGLE release provides trajectory and sight depression for a single cargo bay ejection of three BLU-45/B mines. The bomb range listed in these tables represents the horizontal distance from ejection to the mean point of impact of the three BLU-45/B mines. The BLU-45/B trajectory impact angle, measured from the horizontal, is also listed.

The impact pattern length listed in the ripple release tables for a 10-cargo bay release represents the distance between the mean points of impact for the first and last munitions released. The sight depression from flight path and wind correction factor values assume that the center of the impact pattern is aimed at the target. The tabulated release slant range value represents the distance between initial release and the center of the impact pattern.

If the CBU-33/A is carried on the shoulder positions of either MER or TER, the BLU-45/A impact pattern will be displaced laterally in the direction of the side ejection. The magnitude of this lateral displacement, which is induced by an effective lateral munition ejection velocity component of approximately 14 ft/sec (20 x sin 45°), is indicated in figure 6-23. The quantities listed are measured from the point of ejection and cover the range of release conditions provided in the CBU-33/A bombing tables contained in T.O. 1F-4C-34-1-2.

SUU-38 DISPENSERS

CBU-34/A, A/A, -42/A DISPENSERS AND MINES

The CBU-34/A, A/A -42/A dispenser and mine munitions consist of the SUU-38/A Dispenser (figure 1-87), a payload of mines, and a kit (KMU-338/B) to cluster, retain, explosively eject, and initiate dispersal of the mine payload. The basic SUU-38/A dispenser has 10 cargo bays. Each bay is divided into three separate compartments by an adapter to provide a total of thirty KMU-338/B canister cargo compartments. The KMU-338/B canister cargo is held vertically in the SUU-38/A cargo bay. Each KMU-338/B canister contains a cargo of 18 mines. The mines are sub-munitions (BLU-42/B, A/B and BLU-54/B series mines), spherical in shape with four flutes which facilitate dispersal and arming after the mines are released from the canister. The KMU-338/B canister ejection velocity from the SUU-38/B is approximately 30 ft/sec. The canister opens to release the sub-munition mines approximately 0.7 sec after ejection. The KMU-338/B mine canisters can be ejected at one of the following rates: 0.07, 0.20, 0.35, 0.50, 1.00, or 1.50 sec. The required ejection rate must be set into the SUU-38/A dispenser intervalometer prior to take-off. Only the RKTS & DISP/SINGLE mode can be used to release the canisters from the SUU-38/A dispenser. To empty the dispenser, the release signal must be continuously applied to the SUU-38/A timing circuit for a time duration (2 sec. to 43.5 sec.) determined by the dispenser intervalometer setting: multiply the intervalometer setting by 29. The dispenser does not have a CBU monitor circuit to establish an empty or full dispenser. Releasing the bomb release button causes the stepper switch in the MER/TER to transfer to the next dispenser. The MER and TER switch must be set on CBU. Refer to T.O. 1F-4C-34-1-1A, section I, part 4 for classified description and procedures to determine pattern length. Refer to T.O. 1F-4C-34-1-2 for the ballistic tables.

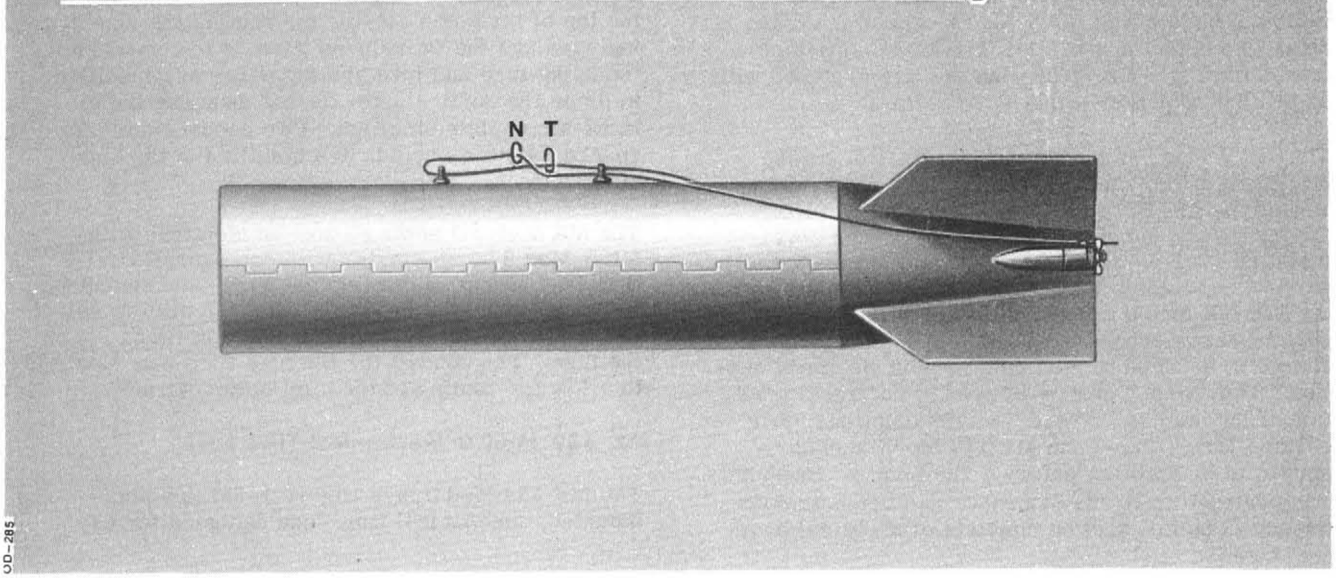
Note

> Ballistic and impact pattern data is identical for the CBU-34/A, and CBU-42/A dispensers and mine munition.

M36E2 INCENDIARY CLUSTER BOMB

The M36E2 (figure 1-87A) is an incendiary cluster munition designed to be used against wooden structures, oil storage areas, and other flammable tar-

M36E2 INCENDIARY CLUSTER BOMB



EXTERNAL STORE LIMITATIONS (Flight Manual)	
WEIGHT	900 Lbs
LENGTH	90 Inches
DIAMETER	16 Inches
FIN SPAN	23 Inches
CAPACITY M126 THERMITE (TH3) BOMBS	177 Each
TAIL FUZES, MECHANICAL TIME M152A1	2 Each

4C-34-1-1-(89)

Figure 1-87A

gets. The dispenser assembly consists of two half-cylinder casings with a continuous piano-type hinge locking system along the sides of the case halves. The upper case contains the 14-inch supsension lugs and an internal hard-back to sustain forced ejection. Separation of the casings is accomplished by the detonation of a 22-foot length of detonating cord which is threaded through the hinge locking device assembly. A nose cone (or plate) is not used for F-4 carriage. A fin cone is bolted in X configuration to the cylinder body. Two fuzes are installed in fuze wells (180° apart) in the fin cone. The fuzes are mechanical time type, and allow the cluster to be opened at a predetermined time after drop from the aircraft. Detonation of either fuze will open the dispenser.

INCENDIARY

The dispenser contains 176 M126 thermite bombs (4-lbs each). The bomb is hexagonal with a blunt cast iron nose and with 3 retractable fins that extend at bomb/dispenser separation. The body is constructed of magnesium alloy and is 1.6 inches across the hexagon and 19.5 inches in length. An inertia-type fuze is located between the bomb body and fin.

DISPENSER FUZES

The tail cone fuze wells receive the M152A1 tail fuze (2) mounted in-line with the dispenser hinges. The M152A1 is manually set to function from 5 to 92 seconds after arming wire separation.

MK 20 MOD 2 AND MOD 3 CLUSTER BOMB (ROCKEYE II)

The MK 20 Mod 2 or Mod 3 Cluster Bomb (figure 1-88) consists of the MK 7 Mod 2 or Mod 3 folding dispenser containing 247 MK 118 Mod 0 anti-tank bombs (figure 1-88). The clusters are prefuzed with an MK 339 Mod 0 mechanical time fuze.

The MK 7 Mod 2 bomb cluster consists of a nose fairing, a cargo and tail section. The nose fairing houses the MK 339 Mod 0 mechanical time fuze. During ground handling and loading, a fuze cover is installed over the fuze impeller and the fuze safety wire. The aluminum skinned cargo section houses the MK 118 Mod 0 anti-tank bombs which are secured and protected by dunnage. A linear-shaped charge is secured to the inner wall of the cargo section. This shaped charge is used to cut the cluster in half longitudinally when the fuze functions after release which allows the MK 118 Mod 0 bombs to spread in freefall trajectory. The bombs arm shortly after release from the dispenser and detonate upon impact. The tail section consists of a conical body equipped with four foldable, spring-loaded fins. Until release, these fins are held in the folded position by a fin release wire and for ground safety, a fin safety pin. Two conduits are provided along the top of the bomb cluster for routing the fuze arming wire and the fin release wire. All components, including fuze and fuze arming wires are installed in or on the bomb cluster during manufacture to make a complete munition. Two suspension lugs, spaced 14 inches apart, are installed in the bomb cluster.

The MK 7 Mod 3 bomb cluster is identical to the MK 7 Mod 2 bomb cluster with one exception. On the MK 7 Mod 3, a pilot option wire has been added to the MK 339 Mod 0 fuze to allow the pilot to select, in the air, one of the two fuze function times set on the fuze. The conduit for the fuze wire was modified to allow for routing of the pilot option wire.

MK 339 Mod 0 Mechanical Time Fuze

The MK 339 Mod 0 fuze (figure 1-88) is a nose-mounted, mechanical time fuze designed for use

with bomb type dispenser munitions. The fuze has two selectable functioning times, primary and option, with a setting range of 1.2 to 50 seconds in 0.1 second increments for each functioning time. Any setting within the above range may be selected for either functioning time. In the MOD 3 bomb, an option wire is added to allow the AC to select (in flight) one of two fuze function times. This is the essential difference between the Mod 2 and Mod 3 munitions. The Mod 2 fuze functioning time is preset at the time of manufacture to 4.0 seconds but may be reset before flight. The Mod 3 fuze functioning times are preset to 1.2 seconds (primary) and 4.0 seconds (option) and armament crews may reset these times before flight. The functioning time used is determined by the position of the fuze option pin. The option pin is normally held depressed by an option wire which is installed at the time of manufacture. With the option wire installed and the option pin depressed, the fuze will function at the expiration of the selected primary time. When the option wire is pulled allowing the option pin to extend, the fuze will function at the expiration of the selected option time. Once the option wire has been removed, it cannot be reinstalled and the fuze is committed to the option time setting.

At the time of installation into the MK 20 Mod 2 bomb cluster, the MK 339 fuze option wire is removed, disabling the fuze primary time capability. However, the fuze option time capability and settings are not affected. When installed in the MK 20 Mod 3 bomb cluster, the bomb cluster is configured with an option wire for the fuze allowing utilization of either the primary or option time setting as the mission requires. The aircrew selects the time to be used by pulling or not pulling the option wire at weapon release. The option wire is secured in the ejector rack rear solenoid. The option timer functions with an accuracy of ± 0.1 second for settings from 1.2 to 10 seconds, and 1.0% of all settings over 10 seconds.

The arming wire secures both the impeller and the timer starting pin until the wire is withdrawn at release. The arming wire is secured in the forward rack solenoid.

For the Mod 3 munition, the arm nose tail switch is positioned to get either of the two (primary or option) functions in the following manner.

Mod 3 Function	Arm N/T Switch
Primary	Nose
Option	Nose & Tail

A fuze SAFE/ARM indicator under a clear plastic bubble is viewed through the observation window in the upper nose fairing of the dispenser. The fuze is armed when the end of the indicator pin (red) is visible at the base of the plastic indicator bubble.

MK 118 MOD 0 BOMB

The MK 118 Mod 0 anti-tank bomb (figure 1-88) consists of the MK 1 Mod 0 bomb fuzing system, a shaped charge warhead, and fixed, stabilizing fins. When the cluster splits at fuze functioning, the MK 1 Mod 0 bomb fuzing system arms the bomb and the same system detonates the bomb on impact. The shaped charge warhead causes the explosive force of the detonation to be directed forward into the impact point. Refer to T.O. 1F-4C-34-1-1A for additional information.

MK 20 MOD 2, 3 Bombing Tables

The bombing tables provide mission planning data for the WRCS dive toss bombing, low altitude level and 10° dive releases using 1.2 to 8.0 sec fuze function times, and higher altitude level and dive releases where the dispenser is to be opened at a preplanned altitude above ground.

WARNING

To protect the aircraft and aircrew if the cluster does not open as planned and the intact munition detonates high-order at initial impact, the following minimum release altitudes and associated escape maneuvers should be observed during low altitude level or 10° dive releases where the 1.2 fuze function setting is used.

Release Altitude	Release Angle	Escape Maneuver
800 ft AGL	0°	Straight and Level
400 ft AGL	0°	4 G wings-level pullup or 4 G 60° banked turn
900 ft AGL	10°	4 G wings-level pull up

SUU-25A/A FLARE DISPENSER

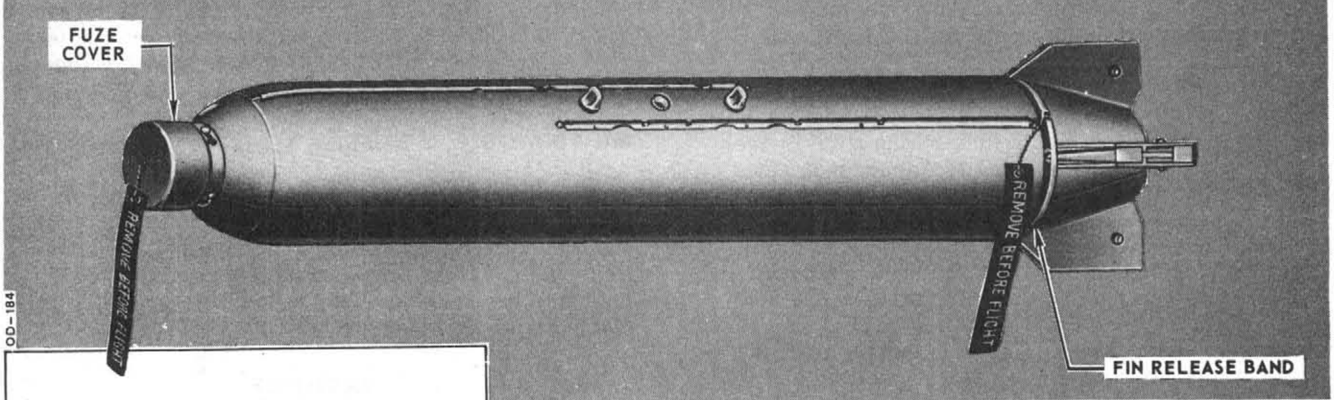
The SUU-25A/A flare dispenser (figure 1-89, sheet 1) contains four tubes, each capable of receiving two MK 24/LUU-2/B flares or LUU-1/B, 5/B, 6/B target markers. A compressed spring in each tube applies the rearward ejection force when the flares or markers are deployed. After a pair of flares or markers are inserted into the tube against the spring, end plugs are installed, and then explosive detents are installed to retain these units against the spring tension. When the AC deploys a pair of flares or markers, the release pulse detonates the explosive detents and the spring ejects the flares or markers rearward.

For ground safety purposes, a shorting device is installed into the aft dispenser electrical receptacle to interrupt the detent circuits. Prior to takeoff, the shorting device is removed and the MER electrical connector is installed. The safety pins with red flag attachments are installed over the end plugs to mechanically safe the ejection system (figure 1-91). To eject the flares or markers, cockpit switching procedures are the same as those for CBU dispensers.

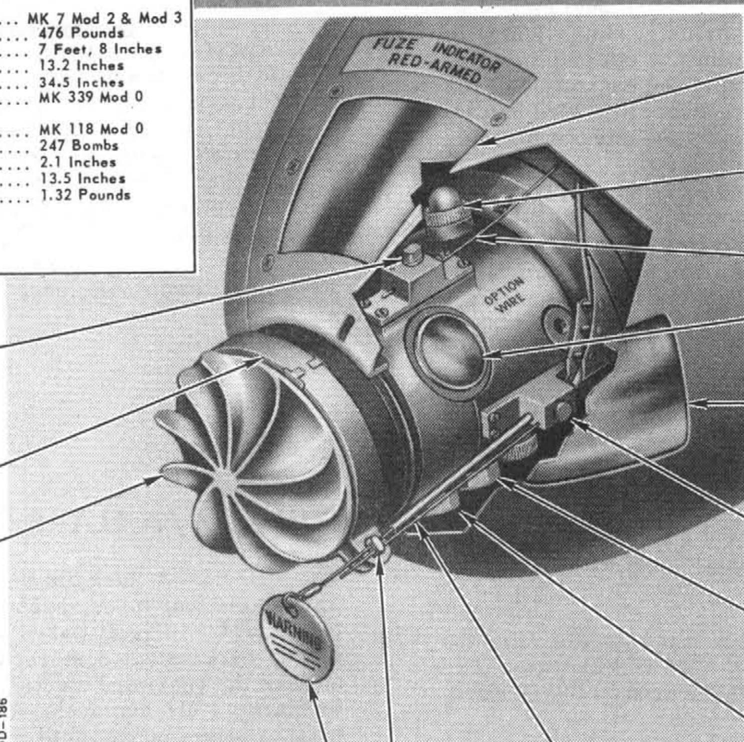
Each flare contains controls (figure 1-89, sheet 2) to set parachute ejection delay time (from 5 to 30 seconds), and flare ignition delay time from 10 to 30 seconds

R.H.

MK 20 MOD 2 & MOD 3 CLUSTER BOMB



DISPENSER	MK 7 Mod 2 & Mod 3
WEIGHT	476 Pounds
LENGTH (With Fuze)	7 Feet, 8 Inches
DIA. (Fins Retracted)	13.2 Inches
(Fins Extended)	34.5 Inches
FUZE	MK 339 Mod 0
BOMB , (Anti tank)	MK 118 Mod 0
CAPACITY	247 Bombs
DIAMETER	2.1 Inches
LENGTH	13.5 Inches
WEIGHT	1.32 Pounds



4C-34-1-1-(90)

Figure 1-88

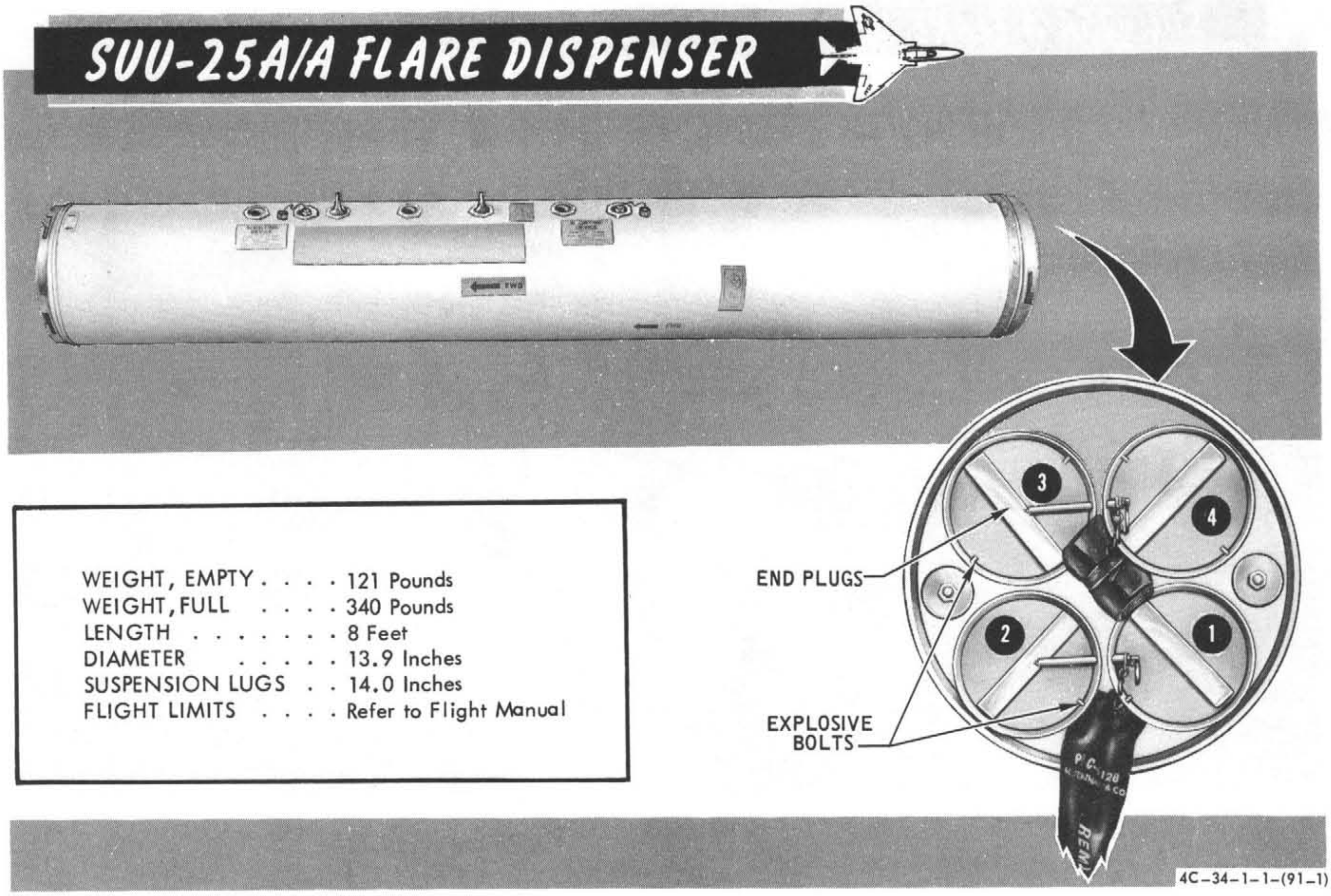
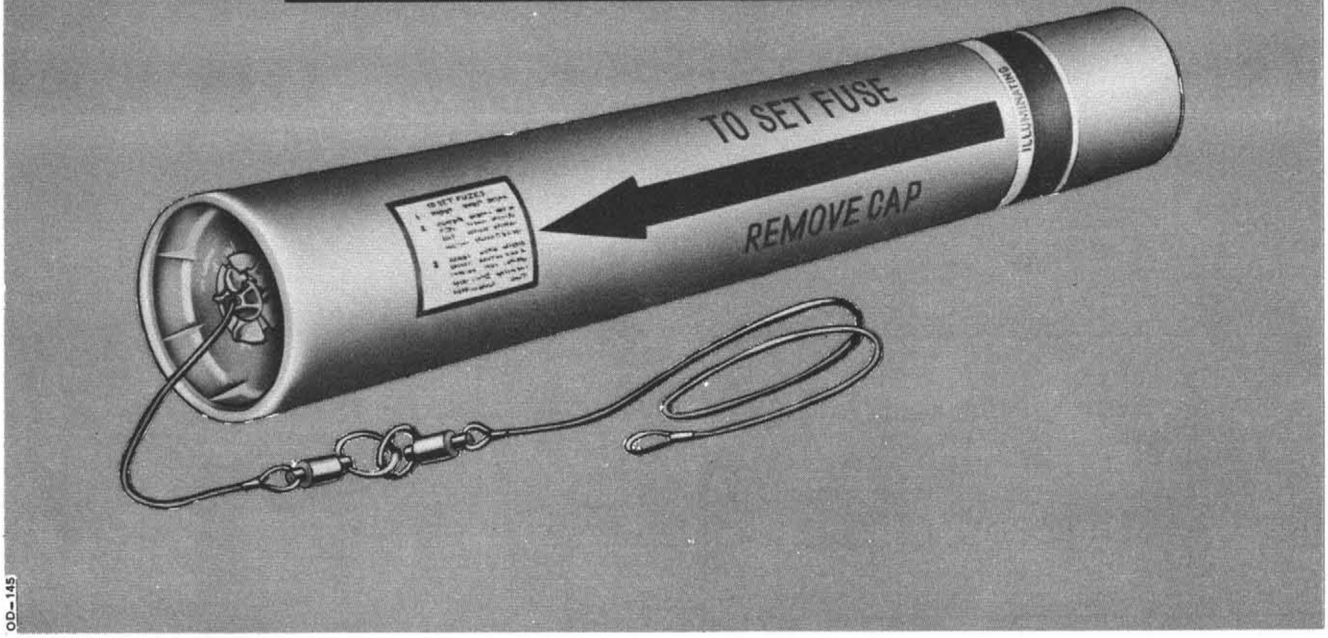


Figure 1-89 (Sheet 1 of 2)

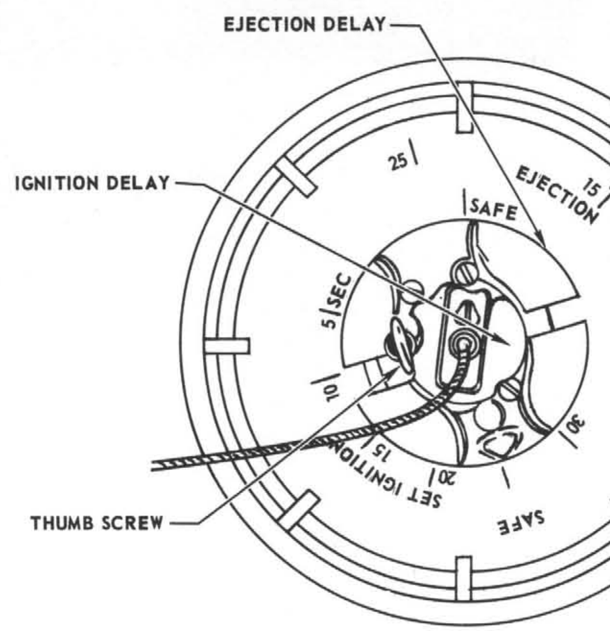
SUU-25A/A FLARE DISPENSERS (CONTINUED)

MK 24 FLARE & LUU-1/B, 5/B, 6/B TARGET MARKERS



TO SET FUZES

1. REMOVE THUMB SCREW.
2. DEPRESS EJECTION DIAL AND TURN CLOCKWISE TO THE DESIRED TIME SETTING, RELEASE PRESSURE AS SETTING IS APPROACHED. DIAL MUST RETURN TO UPMOST POSITION AFTER SETTING.
3. DEPRESS IGNITION DIAL AND TURN CLOCKWISE TO THE DESIRED TIME SETTING RELEASE PRESSURE. AS SETTING IS APPROACHED, DIAL MUST RETURN TO UPMOST POSITION AFTER SETTING.
4. POSITIVE STOP SAFETY PIN MUST BE ALIGNED AS A FINAL OPERATION PRIOR TO FIRING.
5. IF FLARE IS NOT FIRED, REPLACE SAFETY PIN.
6. TO RE-SET ON SAFE, DEPRESS AND TURN IN COUNTERCLOCKWISE DIRECTION TO SAFE.



Note

MK 24 MOD 4 DOES NOT HAVE 5 SECOND IGNITION SETTING.

4C-34-1-1-(91-2)

Figure 1-89 (Sheet 2 of 2)

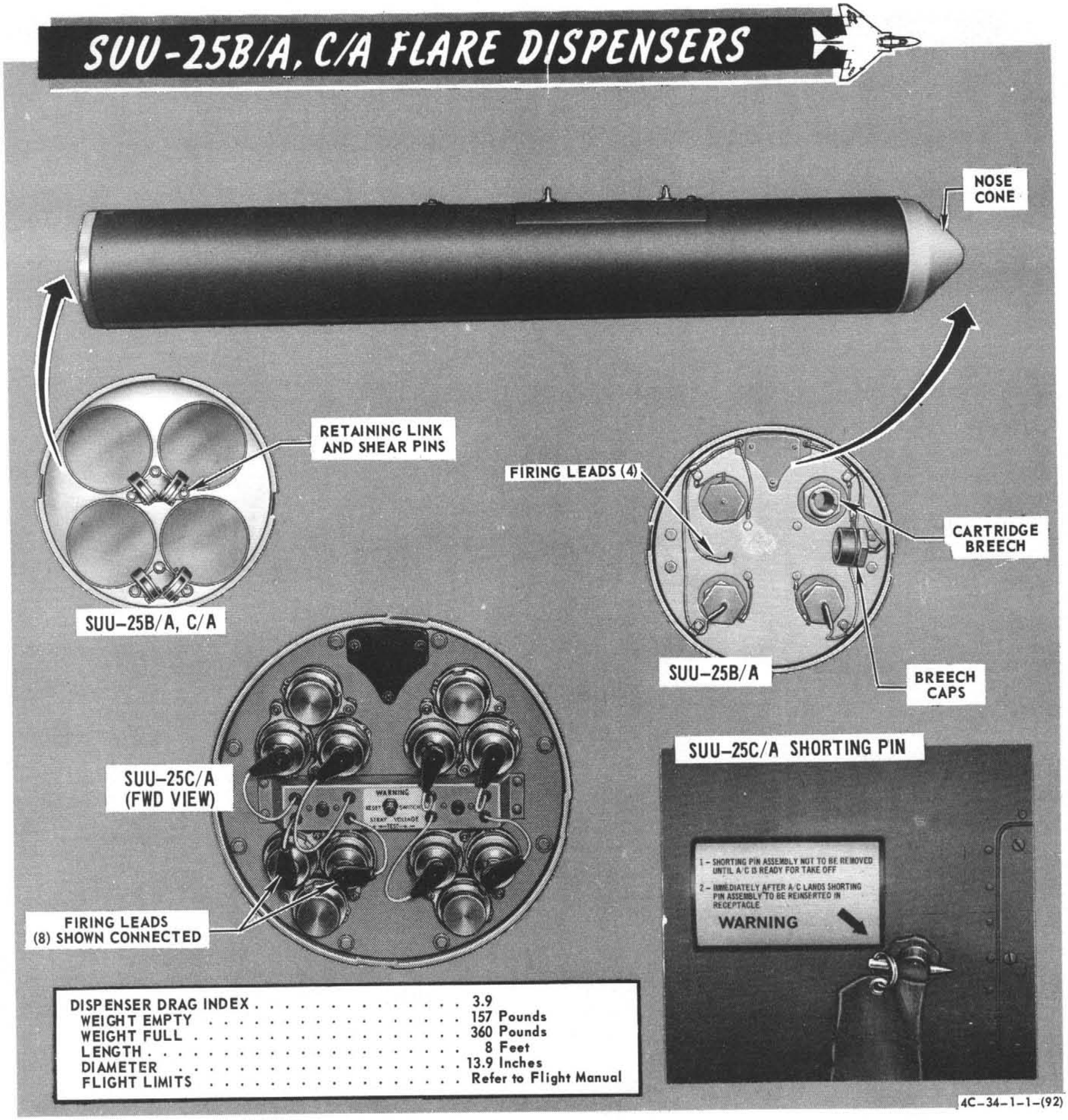


Figure 1-90

on Mod 4 or LUU-1/B,-5/B,-6/B markers. During loading, the controls are removed from their SAFE positions and set on a specific time value (in seconds). A connecting lanyard is installed between each pair of flares or markers, and during ejection, tension on the lanyard initiates the flare or marker fuze train. The two flares or markers are approximately 150 feet apart at flare ignition.

SUU-25B/A FLARE DISPENSER

The SUU-25B/A flare dispenser is capable of dispensing eight MK 24 or LUU-2/B flares or eight LUU-1B, -5/B, -6/B markers, (figure 1-90). The equipment is designed to be returned and used for more than one mission. The dispenser consists of a

center section constructed of four metal tubes enclosed by an outer skin with metal bulkheads on each end. A suspension lug reinforcement plate (strong back) is installed at the top of the center section. Flares/markers are loaded against a compression cushion and are held in place by a retaining link and shear pin. Inpulse cartridges are loaded in the breech assembly at the forward end of each tube. Two electrical receptacles, on top of the center section, permit electrical connection of the dispenser to the aircraft. However, only one receptacle is connected for dispenser operation. Each receptacle is equipped with a shorting button which may be positioned to safe the dispenser electrical circuit. This button is removed from the applicable receptacle before installing the dispenser on the aircraft. This dispenser has no single/ripple mode switch; the intervalometer sequences to fire one tube at a time.

SUU-25C/A FLARE DISPENSER

The SUU-25C/A flare dispenser is capable of dispensing eight MK 24 type flares or flare markers. Single flare dispensing is the primary feature; i.e., the dispenser intervalometer causes one flare to be dispensed with each release pulse. Each of the four tubes has two breech assemblies loaded with an impulse cartridge. One breech is routed to a chamber between the forward and aft flares. The aft flare is dispensed first by cartridge gases creating a temporary compression chamber between the flares.

Eight shear pins are used to retain each flare, four are located in the center section of the dispenser and four in the aft end. All other features of the SUU-25C/A dispenser are the same as the SUU-25B/A dispenser.

LUU-1/B, -5/B, -6/B TARGET MARKER FLARES

The LUU-1/B, -5/B, -6/B target marker flare is 4.87 inches in diameter, 36 inches long, and weighs 26 pounds. The only difference between the three flares is the color of the flame: the LUU-1/B burns red, the LUU-5/B burns green, the LUU-6/B burns fuchsia. These are MK 24 Mod 4 illumination flares with a different candle/parachute assembly installed. The candle is designed to burn for 30 minutes on the ground providing an easily distinguished red/green/ fuchsia colored flame. It is intended that the color be distinguishable in the presence of burning illumination flares.

The candle is inverted (the burning surface ignites on the end connected with the parachute) to reduce the changes of snuffing out the flame on ground impact. The cast candle is 27 inches long, 4 inches in diameter, and weighs 19 pounds, with 16 pounds of flare composition.

A steel suspension cable links the parachute and the wooden suspension block on the bottom of the candle. The suspension cable passes through the center of a 2.75-inch diameter protective core in the center of the candle. The suspension cable extends 6 feet from the top of the candle to a point where it is connected to eight 6-foot shroud lines.

The parachute for the target marker flare is a cruciform design, which utilizes 7.5 x 2 foot panels

sewn together in the form of a plus sign. The parachute is designed to provide a 30 foot per second rate of descent before flare ignition and to snag in the top of heavy foilage, making it useful in jungle areas. After flare ignition the flare has a rate of descent of approximately 15 feet per second.

The 5-to-30-second delay ejection fuze and the 10-to-30-second delay ignition fuze from the MK 24 illuminating flare are used for the target marker flares. Since the ignition of the candle takes place at the end opposite to the ignition fuze, a double ply quickmatch train is coiled inside the ignition fuze cavity and threaded through the protective center core of the candle. The quickmatch is extended into the cavity and is coiled over a hot-burning material called the first fire mixture. The candle has a 1/8-inch coating of the first fire mixture. Formed in the candles are two 1/2-inch diameter by 3-inch long holes filled with a first fire mixture having a 2-minute burn time which increases the capability of the burning candle to withstand ground impact and continue burning.

Standard MK 24 launchers and launching procedures can be used to launch the LUU-1/B, -5/B, -6/B target marker flares. The ejection and ignition fuzes must be set before launching. Upon launching, the pull on the lanyard ignites the ejection fuze. At the conclusion of the ejection fuze delay, an ejection charge expels the candle and parachute from the outer case. The ejection charge also ignites the ignition fuze delay element which in turn ignites the candle.

LUU-1/B, -5/B, -6/B FLARE DELIVERY

The level release tables for the LUU-1/B flare presented in T.O. 1F-4C-34-1-2 are applicable to the LUU-5/B, -6/B flares. The level release tables provide the horizontal travel and vertical drop prior to flare ignition fuze settings. During mission planning a release altitude, an ejection fuze setting, and an ignition fuze setting must be selected which assures flare ignition prior to ground impact. The total time of fall is the sum of the ejection fuze setting plus the ignition fuze setting plus the time of fall after flare ignition based on a rate of descent of 15 ft/sec. For determining wind corrections in feet per knot of wind, multiply the total time of fall in seconds by 1.7.

LUU-2/B FLARE

The LUU-2/B flare is a pyrotechnic illuminating device with a 4.5-minute burn time. The flare weighs approximately 30 pounds and is identical to the MK 24 flare in external dimensions.

Prior to placing the flare into the launcher, the desired free fall distance in feet (delay time) must be set into the timer. This is done by turning the knob in the center of the timer cover clockwise until the pointer is opposite the number of feet desired. The available settings are 500, 1500, 3000, 4500, 6000, 7500, 9000 and 10,500 feet. However, tests have indicated that settings of 7500, 9000, and 10,500 result in vertical fall of 6500, 7500 and 8500 feet respectively.

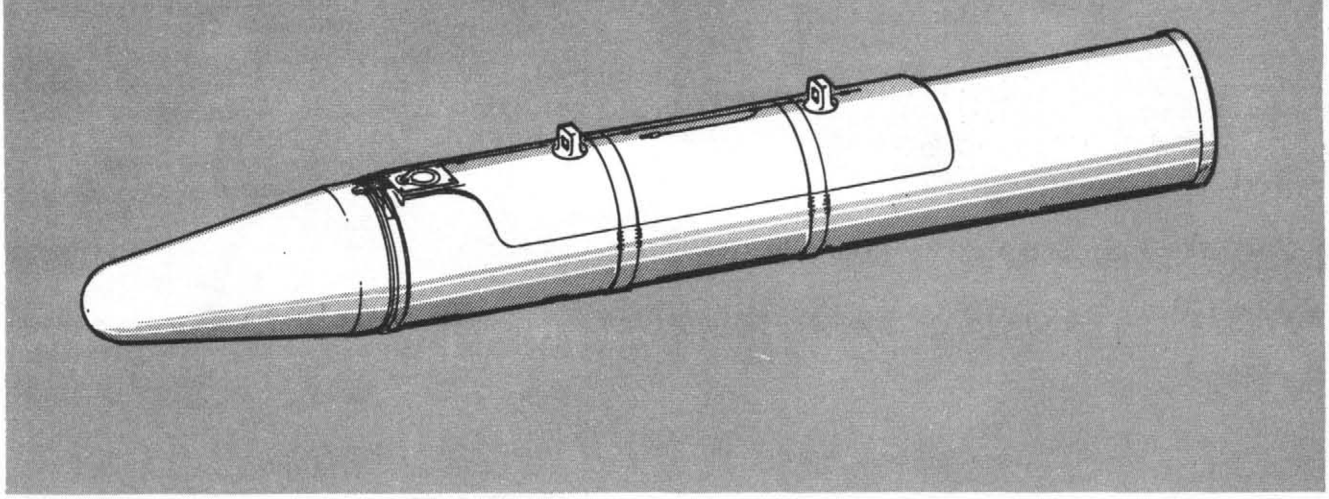
The timer knob will be removed by the launcher as the flare is ejected through the launcher. Removal of the timer cover pulls the timer knob which starts the timer. After the selected delay time, the release mechanism is tripped allowing the timer and cover to be ejected from the flare case by a spring. As the timer is ejected, it pulls the parachute with it. Deployment of the main parachute produces the shock force on the support cables through the ignition lanyard to rotate a bellcrank in the ignition system, shearing a safety pin and cocking and releasing a firing pin. The firing pin strikes and initiates a primer which ignites boron pellets. The boron pellets ignite a wafer of propellant which ignites the flare candle. Pressure buildup on flare ignition blows out pressure relief plugs in the igniter housing after which the flare case burns through, and the ignition housing falls free.

The flare burns for approximately 270 seconds. At candle burnout, an explosive bolt is initiated which releases one parachute support cable causing the parachute to collapse.

MK 24 MOD 4 FLARE

The MK 24 Mod 4 flare is contained in a cylindrical aluminum outer case that is 4.8 inches in diameter and 36 inches long. The Mod 4 flare weighs approximately 27 pounds. The parachute and candle are hermetically sealed inside the outer case by a fuze/timer assembly at one end and a shear plate at the other end. Two mechanical timers control the ejection and ignition sequence. The Mod 4 flare does not have a 5-second setting on the ignition timer. Delays are selected by positioning color coded dials on the fuze end of the flare (figure 1-89) after removing the thumb screw which locks the dials in the safe position. The ejection and ignition sequence is initiated by a 12-pound pull on the braided steel lanyard that is threaded through the center of the settable dials. The cable separates from the flare with a pull of 50 pounds. Caution should be exercised when handling the flare regardless of the status of the fuze, safe or armed, as a 12-pound pull will always function the fuze and render the flare useless if it were safe, or a fire hazard if it were armed. Two MK 24 flares are joined by hooking the fuzing lanyards together. When the flares are ejected from the dispenser into the slipstream, aerodynamic forces cause sufficient pressure to separate the fuze lanyard from one of the flare canisters, activating both fuze timers in the process. The parachute and candle are ejected from the outer case when the ejection delay time is elapsed. The ejection delay time permits the flare to decelerate prior to parachute deployment. Deceleration is required to prevent parachute failure at high release speeds. The ignition timer is actuated at parachute deployment. Upon completion of the ignition time delay, the candle is ignited. The descent of the flare during the ejection

MLU-32/B 99 FLARE (BRITEYE)



DRAG INDEX	1.9
WEIGHT	154 Pounds
LENGTH	63.0 Inches
DIAMETER	8.25 Inches
SUSPENSION LUGS	14.0 Inches
BALLON DIAMETER	20 Inches
OUTPUT, CANDLEPOWER	5 Million
BURN TIME	5 Minutes
VERTICAL FALL DURING BURN	1500 Feet
FLIGHT LIMITS	Refer to Flight Manual

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Figure 1-91

delay time is approximately 200 feet per second; during the ignition delay time, approximately 15 feet per second; after flare ignition, approximately 7.5 feet per second. The actual time that the flare remains suspended after ignition and after burnout is a function of the altitude at time of ignition, the amount of hot air captured under the parachute canopy, and the air currents. Refer to the SUU-25A/A, -42/A Flare Dispensing bombing table, T.O. 1F-4C-34-1-2.

MLU-32/B99 FLARE (BRITEYE)

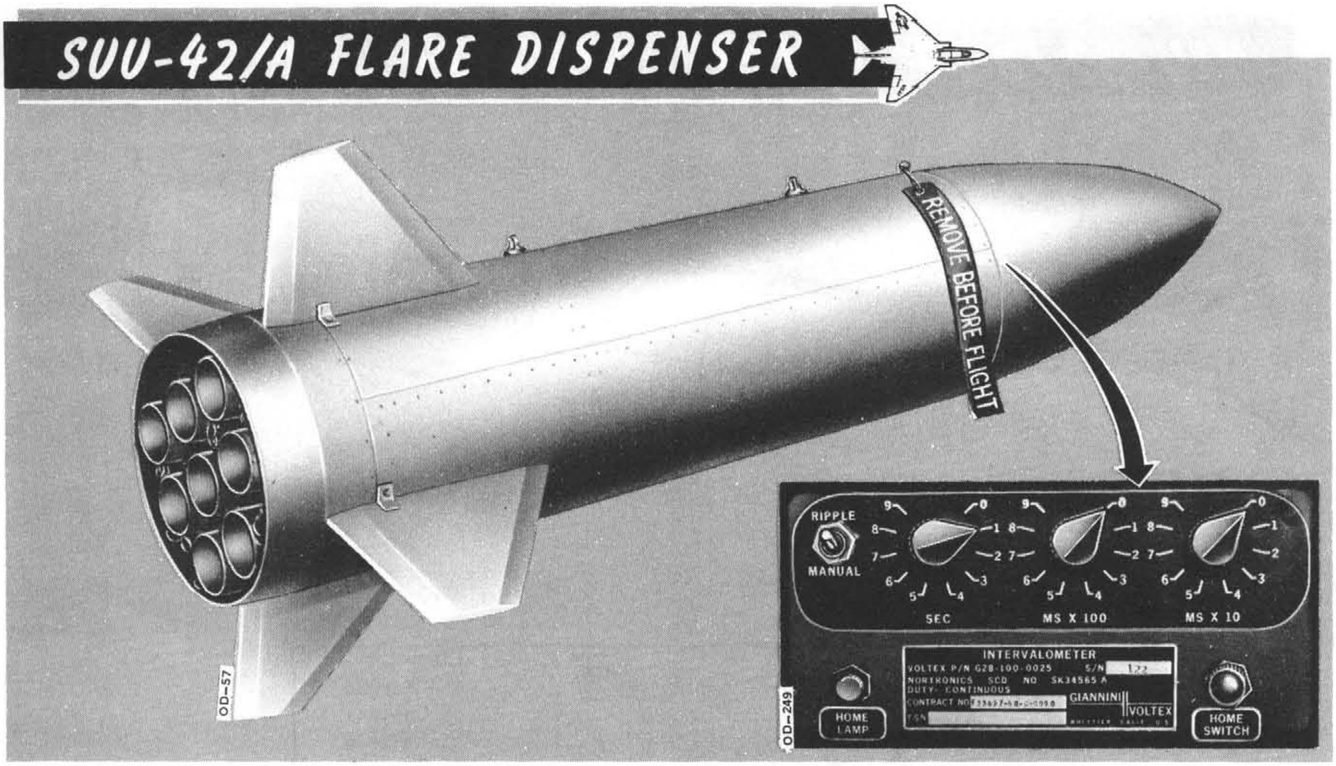
The MLU-32/B99 flare (figure 1-91) is a five million candlepower pyrotechnic illuminating device which burns for 5 minutes. A 19-foot diameter hot air balloon is used to achieve a descent rate of 3 fps. A preburnout (red) warning signal is ignited during the last 30 seconds of burning. The flare has a mechanical timer instead of a fuze, a heat generator to provide the desired thermodynamic properties to the balloon, and a lift destruct system initiated upon completion of flare burning. The flare is externally carried and suspended from the MER and TER.

The flare produces approximately 0.4 foot candles of illumination on the combat area. This compares to approximately 20 times full moon light.

When the flare is released from the MER/TER, the flare timer is initiated by the withdrawal of the arming wire. The adjustable timer provides a minimum delay of 2 seconds (and a maximum of 20 seconds) for safe aircraft separation. After completion of the selected time interval, the timer mechanically initiates an explosive bolt. Separation of the bolt allows the clamp assembly to release the two halves of the outer case. Internal compression springs in the case sections assist the separation of the inner flare assembly from the outer case sections.

As the forward outer case section separates from the inner flare assembly, the drogue chute is deployed. The initial jerk on the drogue chute suspension line initiates the pyrotechnic delay reefing line cutter. During the 3 second delay of the reefing line cutter, the inner flare assembly is decelerated to a safe balloon deployment speed. Upon completion of the delay, the drogue chute strips the deployment case off to deploy the balloon. Completion of balloon inflation tensions the internal Y-bridle which in turn mechanically initiates the flare igniter. The flare igniter directs an intense, short duration flame on the surface of the candle and heat generator, igniting both.

The high temperature gases from the ignited candle burn through the thin aluminum ring thus allowing the



WEIGHT EMPTY	384 Pounds
LENGTH	11 Feet, 8 Inches
DIAMETER.	23 Inches
SUSPENSION LUG DIST., . . .	30 Inches
NO. OF TUBES	8 Tubes (2 Flares or markers per tube)
PAYLOAD.	MK 24 Mod 4, LUU-2/B Flares or LUU-1/B, -5/B, -6/B Markers
FLIGHT LIMITS.	Refer to Flight Manual

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Figure 1-92

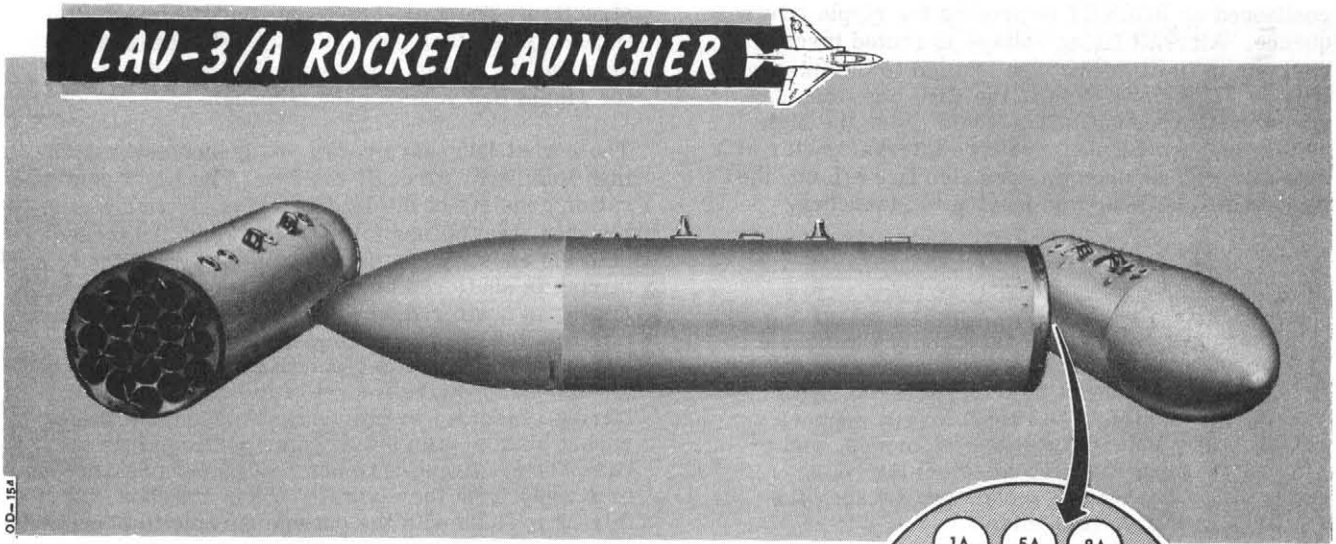
candle to tip over (rotate) and play out the suspension cable which is housed in the base of the candle. The burning face of the candle faces the ground when the flare system is fully deployed.

The MLU-32/B99 level release table T.O. 1F-4C-34-1-2 provides the flare horizontal travel and vertical drop from release to ignition for the range of available timer settings (2 - 30 seconds). Since the flare will fall approximately 1500 feet during the 5-minute burn time, the vertical drop for the selected timer setting must be increased at least 1500 feet to determine a release altitude which will assure flare burn-out prior to impact.

SUU-42/A FLARE DISPENSER

The SUU-42 dispenser (figure 1-92) is a single carriage unit mounted directly on the outboard armament pylons for carriage on the outboard wing stations. The dispenser is modified to carry the MK 24 Mod 4 flares, the LUU-1/B, -5/B, -6/B markers or the LUU-2/B flares. The LUU-1/B, -2/B, -5/B, -6/B, is identical in dimensions to the MK 24 Mod 4 flare.

The SUU-42 dispenser has eight ejection tubes that can carry two flares (markers) per tube. The flares are ejected from the tail section of the dispenser when the bomb button is depressed. A safety pin is installed in each dispenser to prevent accidental discharge during ground operations. The dispenser has a ground settable intervalometer with settings from 0.01 to 9.99 seconds. Three knobs are settable in increments 0.01, .10, and 1.00 seconds with a lowest reliable setting of 0.10 second. The dispenser also has a selector switch with positions of MANUAL and RIPPLE. With the weapon selector knob in the cockpit positioned to RKTS & DISP/SINGLE and the SUU-42 selector switch in MANUAL, a single flare is released from the dispenser for each actuation of the bomb button. With the SUU-42 selector switch in RIPPLE, continuous bomb button voltage (bomb button depressed) releases the flares at a rate determined by the dispenser intervalometer. With the weapon selector knob in RKTS & DISP/RIPPLE, the SUU-42 selector switch must be set to MANUAL. In this case, continuous bomb button voltage (bomb button depressed) is directed to the aircraft intervalometer where a release pulse is alternately delivered to each selected station at the rate determined by the interval switch.



WEIGHT, EMPTY:	78 Pounds
WEIGHT, FULL:	415 Pounds (19 Rockets)
LENGTH:	7 Ft., 3 Inches
DIAMETER:	16 Inches
FLIGHT LIMIT:	Refer to Flight Manual

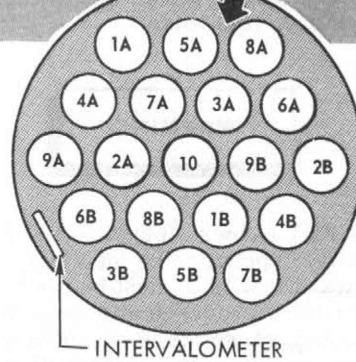


Figure 1-93

Note

The weapon selector knob is normally positioned to RKTS & DISP/SINGLE for dispensing flares from the SUU-42. However, if the SUU-42 selector switch is set to MANUAL, the weapon selector knob may be positioned to RKTS & DISP/RIPPLE if a ripple release is desired.

LAU-3/A ROCKET LAUNCHER

The LAU-3/A rocket launcher (figure 1-93) carries and launches nineteen 2.75-inch folding fin aircraft rockets. The flight configuration consists of the loaded center-section assembly with streamlined fairings installed and locked onto the ends. When the launcher is fired, the front fairing is shattered by rocket impact, and the tip of rear fairing is shattered by rocket blast. The frangible fairings are made of treated paper and shatter readily after the rocket impact and blast. When attached, the fairing is flush with the outside surface to provide an aerodynamically smooth joint. Approximately 11 inches of the base of the rear fairing will remain on the adapter to channel rocket debris away from the undersurface of the wing. The launcher center section is constructed of 19 paper tubes clustered and bonded together to form an integral part of the structure and wrapped with a thin aluminum outer skin. Detent devices within the tubes restrain the rockets against normal flight loads and provide electrical contact to ignite the rockets. Contact fingers on the aft bulkhead provide a ground to complete the circuit through the rockets. Two receptacles on top of the center section provide the connection to the aircraft rocket-firing circuitry. These receptacles are wired in parallel; therefore, only one of them is connected to the aircraft. A shorting pin is inserted in the side of the LAU-3/A launcher. The shorting pin is a ground safety device which is removed prior to flight. Electrical power for the rocket ignition system is supplied to the launcher by the 28 volt dc armament circuit of the aircraft. The burn-out, wire type intervalometer, located within the LAU-3/A launcher, converts the aircraft firing voltage into a ripple fire pulse with a 10-millisecond delay interval. The rockets will ripple fire in pairs until the launcher is empty. The launcher should completely fire-out in approximately 0.1 second. The switch on the MER and TER must be

positioned on ROCKET to provide the ripple fire sequence. Aircraft firing voltage is routed through a resistor to limit the voltage applied to the intervalometer. If the switch is in the CBU position, the resistor is bypassed. This would cause the high voltage to burn out the wire type intervalometer at a rate that will produce a near salvo fire effect: the rockets will collide upon leaving the launcher.

Note

There are several intervalometers available for use with the LAU-3/A; some are reusable. The burn-out unit supports the ripple fire mode only. The reusable type support both the ripple and single-fire modes, and include a reset switch to select the firing modes. In a singles mode, two rockets are fired with each fire pulse.

WARNING

The ROCKET harness (blue) and the CBU harness (yellow) appear to be identical; the harness marked ROCKET must be used. If the CBU harness is inadvertently used, stray voltage might cause the launcher to salvo fire when aircraft power is applied if/when the weapons selector knob is positioned on RKTS & DISP with the armament safety override IN or the landing gear handle UP; the MA switch need not be in ARM, nor the bomb button depressed for this to happen. If the rocket launcher does not fire by stray voltage, it will not fire under normal select and fire conditions; the launcher should be released prior to landing.

LAU-32, -59, -68 ROCKET LAUNCHERS

The LAU-32A/A, -32B/A, -59/A, -68A/A rocket launchers are illustrated in figure 1-95. The LAU-32A/A is the combat model which is normally released after the seven 2.75-inch rockets have been fired. The main differences between the launchers are that the LAU-32B/A, -59/A, -68A/A are reusable rocket launchers that have aluminum launching tubes (instead of paper), an intervalometer which is adjustable and reusable, and a selectable option of SINGLE fire or RIPPLE fires. The LAU-59/A, as it differs from the LAU-32B/A, is of heavier construction. The LAU-68A/A is approximately 10 inches longer than the other 7-tube launchers to accomodate a longer warhead. Refer to figure 1-95 for ripple fire rate of each launcher.

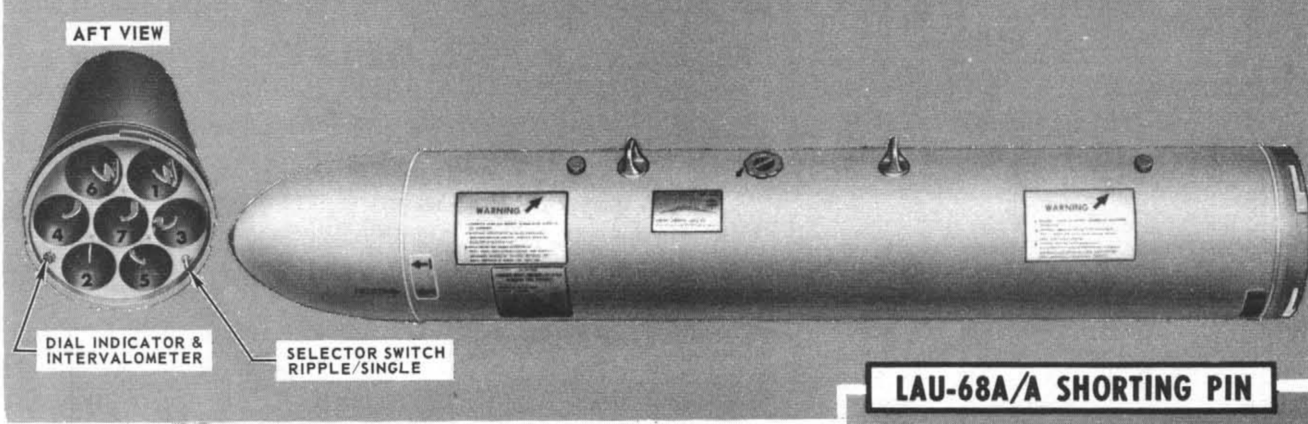
The rocket launchers carry and launch seven 2.75-inch folding fin aircraft rockets. The flight configuration consists of the loaded center-section assembly with streamlined fairings installed and locked onto the ends. When the launcher is fired, the front fairing is shattered by rocket impact, and the rear fairing is shattered by rocket blast. The frangible fairings are made of an impregnated molded fibre, designed with a waffle type structure which is shattered readily by the impact of the rocket. The aft fairing is molded in two sections, such that the rocket blast shatters the center portion while the base section remains to act as a funnel to direct debris away from the aircraft. When attached, the fairing is flush with the outside surface to provide an aerodynamically smooth joint.

The launcher center section is constructed of seven paper tubes clustered and bonded together to form an integral part of the structure and wrapped with a thin aluminum outer skin. Detent devices within the tubes restrain the rockets against normal flight loads and provide electrical contact to ignite the rockets. Contact fingers on the aft bulkhead provide a ground to complete the circuit through the rockets. Two receptacles on top of the center section provide the connection to the aircraft rocket-firing circuitry. These receptacles are wired in parallel; therefore, only one of them is connected to the aircraft. LAU-59 and LAU-68A/A launchers have a shorting pin installed which is removed prior to flight. Electrical power for the rocket ignition system is supplied to the launcher by the 28 volt dc armament circuit of the aircraft. The burnout, wire type intervalometer, located within the LAU-32A/A launcher, converts the aircraft firing voltage into a ripple fire pulse with a 10-millisecond delay interval. The rockets will ripple fire until the launcher is empty or the bomb button (pickle button) is released. The LAU-32A/A launcher should completely fire-out in approximately 0.07 second. The LAU-32A/A intervalometer is the same, and interchangeable with the LAU-3/A launcher.

The LAU-32B/A, -59/A, -68A/A launcher has an adjustable intervalometer located on the aft bulkhead. The intervalometer dial has the following positions: LOAD, ARM, and 1-2-3-4-5-6-7. To select a particular tube for firing, set the intervalometer dial on the preceding tube)e.g. to fire tube 5 set dial on tube 4). The LOAD position is electrically safe. Before installing the aft fairing, the dial is moved

Figure 1-94 deleted

LAU-32,-59/A,-68A/A ROCKET LAUNCHER



	LAU-32A/A	LAU-32B/A	LAU-59/A	LAU-68A/A
SINGLE FIRE OPTION....	NO	YES	YES	YES
REUSABLE..............	NO	YES	YES	YES
RIPPLE RATE............	0.010 Sec	0.020 Sec	0.020 Sec	0.060 Sec
WEIGHT, EMPTY........	41.5 Lbs	51.5 Lbs	56.0 Lbs	67 Lbs
WEIGHT, FULL..........	164 Lbs	174 Lbs	184 Lbs	217.5 Lbs
LENGTH................	67 In	67 In	62 In	72.63 In
DIAMETER..............	10 In	10 In	10 In	9.8 In

LAU-68A/A SHORTING PIN

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Figure 1-95

counterclockwise to the ARM position. The LAU-32B/A, -59/A, -68A/A has an option selector switch, located at the top of the aft bulkhead, with two positions: one position is RIPPLE and the other is SINGLE. The selection is made prior to installation of the aft fairing.

The switch on the MER and TER must be positioned on ROCKET. Aircraft firing voltage is routed through a resistor to limit the voltage applied to the intervalometer. If the switch is in the CBU position, the resistor is bypassed. This will cause the high voltage to operate the intervalometer at a rate that will produce a near salvo fire effect; the rockets will collide upon leaving the launcher.

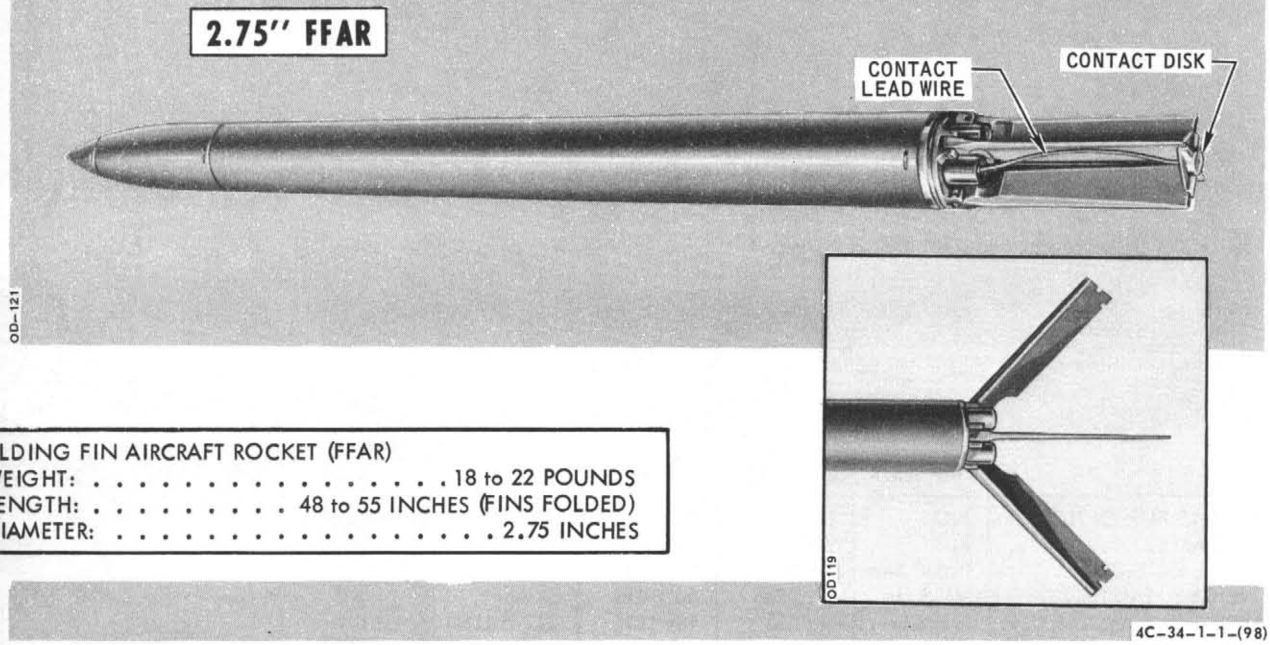
WARNING

The ROCKET harness (blue) and the CBU harness (yellow) appear to be identical; the harness marked ROCKET must be used. If the CBU harness is inadvertently used, stray voltage might cause the launcher to salvo fire when aircraft power is applied if/when the weapons selector knob is positioned on RKTS & DISP with the armament safety override IN or the landing gear handle UP. The master arm switch need not be in ARM, nor the bomb button depressed for this to happen. If the rocket launcher does not fire by stray voltage, it will not fire under normal select and fire conditions; the launcher should be released prior to landing.

2.75-INCH FOLDING FIN AIRCRAFT ROCKET

The 2.75-inch folding fin aircraft rocket (FFAR) (figure 1-96) is designed to provide air-to-ground armament for tactical aircraft. The rocket can be configured with various rocket heads (warheads) and fuzes to accommodate the tactical requirement; high-explosive (HE), anti-tank (HEAT), fragmentation (pearlite malleable iron, PMI), flechette (steel darts), or a plaster-loaded inert head used for practice (figure 1-96). The rocket motor tube is made of seamless aluminum alloy tubing and is 32 inches long. The rocket motors are designated MK 4 Mods 0 thru 8. The propellant used is an internal burning grain ballistite. The burning rate of the propellant varies with temperature, from 2.92 seconds at -50°F to 1.42 seconds at 130°F. The propellant grain in rocket motors MK 4 Mods 0, 1, 2, and 3 is sensitive to temperature change. The propellant grain used in rocket motors MK 4 Mods 4, 5, 6, 7 and 8 is relatively insensitive to temperature change. The rocket motor is ignited by aircraft electrical power through an igniter. An electric squib ignites the mixture of black powder and magnesium powder contained in the igniter. The igniter is located at the forward end of the rocket motor in the head closure of the motor assembly. The rocket nozzle/fin assembly, which attaches to the rear end of the motor tube, consists basically of a nozzle plate,

2.75-INCH FOLDING FIN AIRCRAFT ROCKET



FOLDING FIN AIRCRAFT ROCKET (FFAR)	
WEIGHT:	18 to 22 POUNDS
LENGTH:	48 to 55 INCHES (FINS FOLDED)
DIAMETER:	2.75 INCHES

Figure 1-96

four nozzles, a fin actuating mechanism, four folding fins, and a fin retainer and contact disc. Gas pressure from the motor operates the piston and cross head, pushing the heels of the fins and thereby causing the fins to open. The cross head remains in its rearmost position and is effective in locking the extended fins in their normal angular projection rearward against the force exerted by the airstream even after loss of external pressure at motor burn-out. The fins are shaped aluminum alloy plates, 6.5-inches long and 1.26-inches wide. When folded, they extend to the rear within the 2.75-inch diameter of the round.

CAUTION

For use of 2.75-inch FFAR on F-4 aircraft or in the SUU-20/A dispenser, only the plastic type fin retainer or contact disc without metal picture frame are approved. To use the contact disc without metal picture frame, it is necessary to hold fins closed or in folded position with tape.

2.75-INCH ROCKET WARHEADS

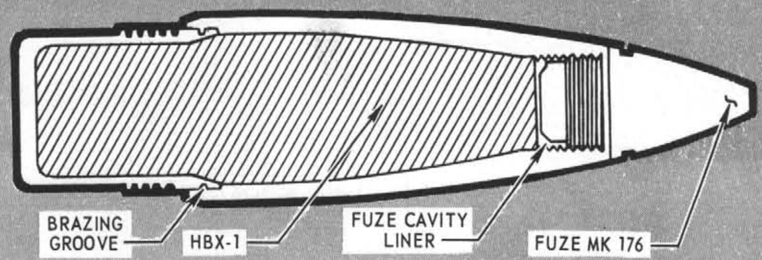
MK 1 WARHEAD (HE)

The MK 1 high explosive (HE) rocket warhead (figure 1-97) is 11.1-inches in length and weighs 6.47 pounds with fuze installed. The warhead is loaded with 1.4 pounds of HBX-1 high explosive for blast, fragmentation, mining or demolition effects. The high explosive (HE) head uses the MK176, MK178 or M427 point detonating fuze. The M178 fuze would allow the warhead to penetrate for internal blast and mining, whereas the M427 fuze would provide a surface burst. The inert warhead has the same configuration and carries an inert load of plaster and a dummy fuze.

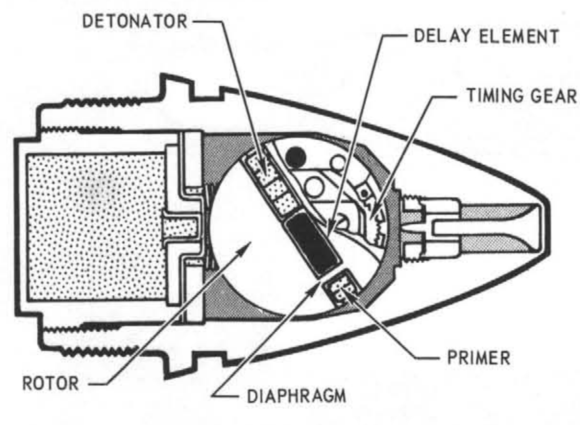
MK 5 WARHEAD (HEAT)

The MK 5 (HEAT) warhead has the same dimensions and weight as the HE warhead. All models of the HEAT warhead are designated MK 5. The MK 5 warhead is constructed with a shaped charge for penetration of armored vehicles, tanks, and other resistant targets. The length and weight with the MK 181 base detonating fuze installed is the same as the HE head. The HEAT head is loaded with 0.89 pound of composition B and with a shaped charge for penetration of armored or other resistant targets. The shaped charge is designed to focus all the energy of the detonation into a narrow, high velocity jet. At impact, the base detonator (located at the base of the fuze) is ignited to detonate the explosive charge. The shock waves of the detonation move forward from the base toward the apex of the thin metal liner that

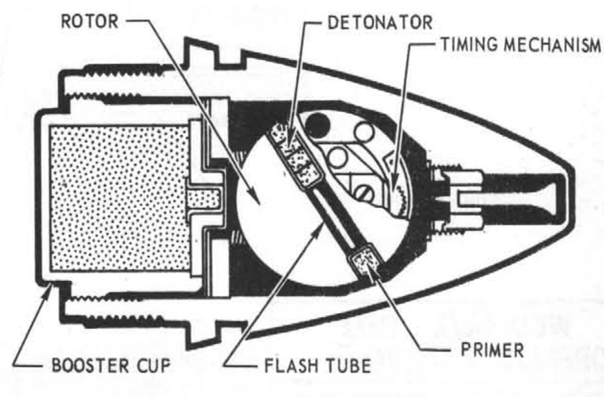
2.75-INCH FFAR WARHEADS and FUZES



M1 Warhead (HE)

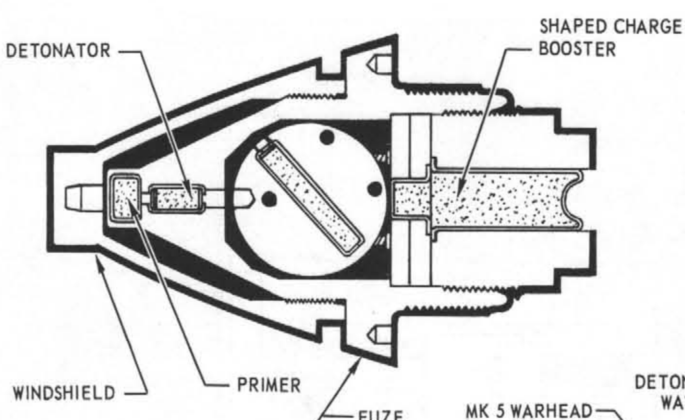


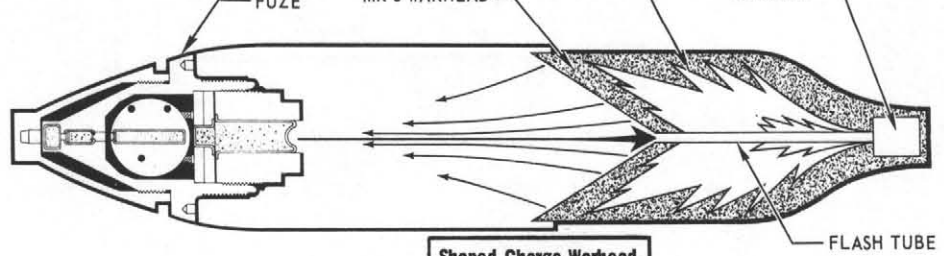
MK176 Fuze (PD)



MK178 Fuze (PD)

MK5 Warhead (HEAT) and MK181 Fuze (Point Initiation–Base Detonation)





Shaped Charge Warhead

2.75 COMPONENTS	
2.75" Rocket Motor MK 4 Mods 0 thru 8	
FUZE	**WARHEAD**
WDU-4A/A	WDU-4A/A (FLECHETTE)
M427 Mods 0, 1	M151 (PM1 or WP)
MK 176 Mods 1, 2	MK 1 Mods 1, 3, 4, 5
MK 178 Mods 0, 1, 2	
MK 181 Mod 0	MK 5 Mod 0 (HEAT)

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Figure 1-97 (Sheet 1 of 2)

2.75-INCH FFAR WARHEADS & FUZES (CONTINUED)

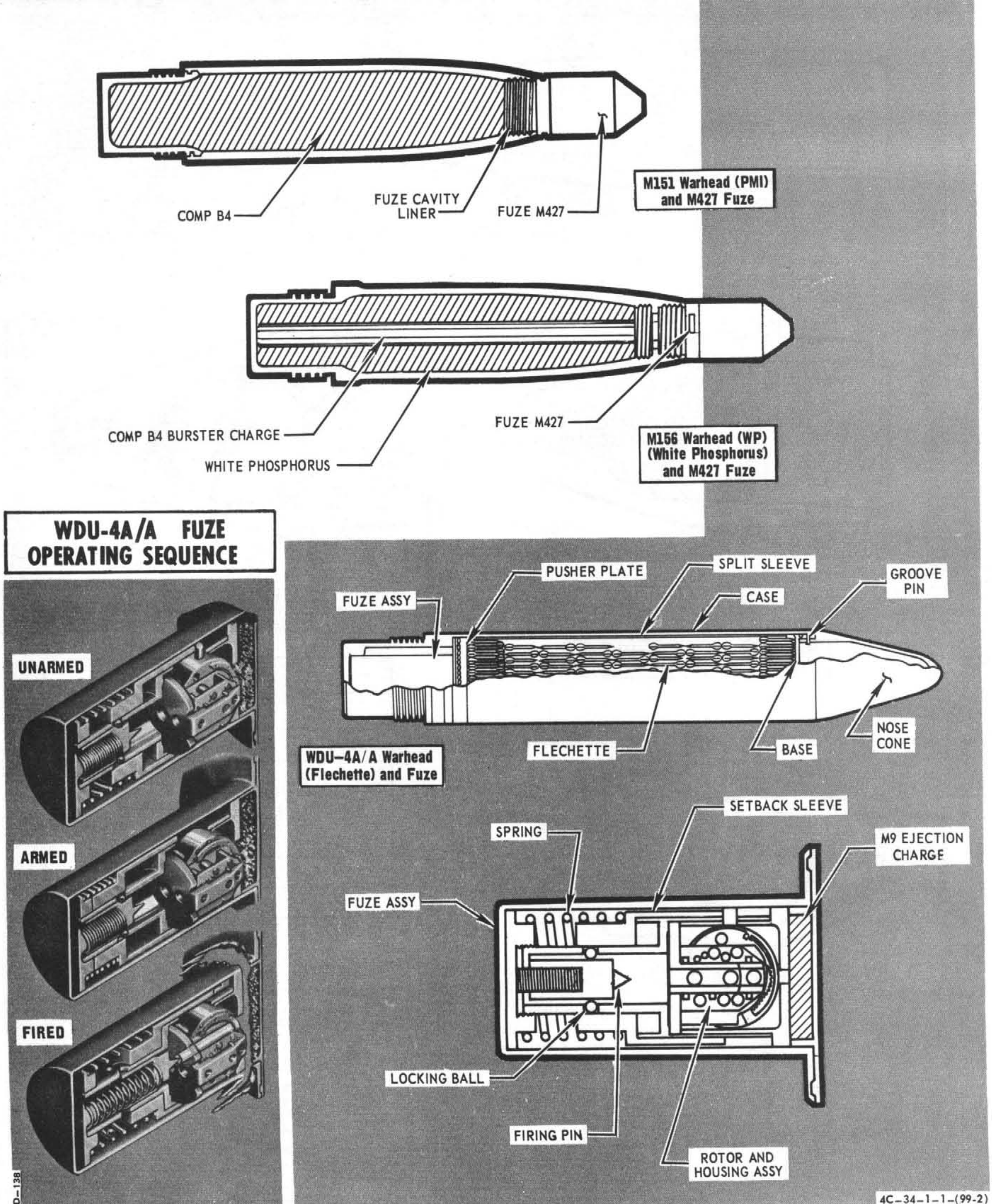


Figure 1-97 (Sheet 2 of 2)

forms the concaved cone at the front of the shaped charge. (The strong outer shell of the shaped charge is not shattered by the detonation.) Collapse of the thin metal liner starts at the apex of the cone. As the liner collapses, it ejects a narrow jet of explosive products and metal particles at extremely high velocities. The jet is first to strike the target, followed by the main body of the cone, referred to as the secondary penetration or the slug. When the jet strikes in target, pressures up to 250, 000 pounds psi are produced at the point of impact. The depth of jet penetration is a function of the target density rather than strength. There is no appreciable lateral blast effect or temperature rise produced by the shaped charge, since all the energy is directed forward.

M151 WARHEAD (PMI)

The M151 warhead has a pearlite, malleable iron (PMI) case designed to produce high fragmentation. The warhead is employed as an air-to-ground, anti-personnel and anti-material weapon. The warhead is 2.75 inches in diameter, approximately 15 inches in length, and weighs 9.4 pounds with the M427 superquick fuze installed. The warhead is loaded with 2.37 pounds of Comp B-4 explosive for fragmentation and blast effect. The superquick fuze, greater length of warhead, and improved fragmentation break-up of the PMI case combine to provide more than twice the effectiveness of the standard HE warhead.

M 156 WARHEAD (WP)

The M156 warhead filled with 2.13 pounds of White Phosphorus (WP) has the same external shape as the M151 (PMI) warhead. A bursting tube containing three ounces of Comp B-4 is inserted through the center axis of the warhead. The explosive tube is detonated upon impact by the M427 fuze to cause dispersion of the White Phosphorus.

White Phosphorus (WP) is a yellow, wax-like substance that melts at 111°F. The most characteristic property of WP is spontaneous ignition when exposed to air, burning with a yellow flame and giving off a large volume of white smoke. The smoke in field concentrations is not toxic; however, the fumes are toxic.

WARNING

If white smoke is detected arising from a leaking warhead, there is an immediate danger of fire.

WDU-4A/A WARHEAD (FLECHETTE)

The WDU-4A/A warhead is a flechette (miniature steel dart) anti-personnel warhead. The WDU-4A/A warhead is 2.75 inches in diameter, 17.76-inches long, weighs 9.4 pounds, and contains a base fuze, ejecting charge, piston, 2200 20-grain flechettes, and an aerodynamic nose cone (figure 1-97 sheet 2). The WDU-4A/A warhead is compatible with all 2.75-inch FFAR motors and launchers. The fuze is installed during assembly and is an integral part of the warhead. At launch, acceleration forces arm the fuze. At motor burn-out (approx. 1.8 sec. after launch), an airburst is initiated by the deceleration forces which frees the spring loaded firing pin to ignite the M9 ejecting charge. The M9 ejecting charge generates a gas pressure against the pusher plate (piston) which transmits the pressure through the stacked flechettes and to the shear pins on the nose cone. The shear pins are broken to allow the nose cone to be ejected, followed by the flechettes. The flechettes are packed tightly in the split sleeves with alternating flechettes pointing fore and aft. When the flechettes are ejected, aerodynamic forces cause the tail-forward flechettes to tumble and streamline; this weathervaning causes dispersion. Slant range at launch is a factor in determining the slant range at rocket motor burn-out, and therefore, is a critical factor in determining the dispersion and weapon effectiveness. Refer to the rocket launch table for flechette warhead ballistics, T.O. 1F-4C-34-1-2. Refer to the Confidential manual T.O. 1F-4C-34-1-1A, Supplementary Data, for the planning charts used to determine impact pattern size and optimum launch conditions.

2.75-INCH ROCKET FUZES

MK 176 FUZE (PD)

The MK 176 fuze is a cone-shaped, steel constructed point-detonating, delay, nose fuze. The fuze is detonator-safe and is armed when the sustained acceleration of the rocket motor overcomes the force of the anti-setback springs that restrain the weight of the fuze arming mechanism. The rate of acceleration required for arming is approximately 20 Gwhich insures that the rocket will travel at least 500 feet before the fuze arms. The maximum distance allowed for arming is approximately 1400 feet. The fuze contains the firing mechanism, arming mechanism, primer, delay element, detonator, lead and booster. The delay element provides a 0.0003 second delay. The fuze is threaded at the lower end for attachment to the HE or PMI warheads.

MK 178 FUZE (PD)

The MK 178 fuze is similar to the MK 176 fuze in every respect except that the delay element between the primer and the detonator has been removed and replaced by a flash tube to reduce fuze function time. The production model is designated Mod 2.

M 427 FUZE

The M427 fuze provides a superquick, graze sensitive fuze that will provide warhead detonation above ground to increase the fragmentation produced by the M151 warhead. The M427 fuze is also used with the White Phosphorus filled M156 warhead. The M427 fuze is detonator-safe, employing a detonator-out-of-line rotor that is brought into alignment by the G forces of rocket motor acceleration. The detonator-safe mechanism installed in the M427 is basically

the same as that installed on the MK 176/178, requiring 20 G for approximately 1 second to complete the arming sequence. This provides a minimum of 500 feet, to a maximum of 1200 feet of safe travel before the warhead is armed. The M427 fuze will function instantaneously without ricocheting off hard ground or burying in a soft mud or water. The front of the fuze contains a striker plate which centers an auxiliary striker pin over the firing pin. The striker plate transmits any backward vector force to the firing pin to assure reliable functioning at low impact angles (approximately 3 degrees).

MK 181 FUZE (POINT INITIATING-BASE DETONATING)

The MK 181 fuze is used exclusively with the HEAT warhead (shaped-charge). The M181 fuze contains a shaped-charge booster that directs a jet of hot gas rearward to the base of the HEAT warhead to initiate the booster pellet which in turn initiates the main charge of the HEAT warhead. Upon impact, the shaped-charge booster is initiated. The booster is concaved at the base to direct a jet stream through the apex of the HEAT shaped-charge and flash tube to ignite the booster pellet located at the base of the warhead. The booster pellet in turn ignites the HEAT shaped-charge to produce a greater jet in the opposite direction. This design is to achieve faster fuze functioning, thereby increasing overall efficiency of the shaped-charge HEAT head. The arming mechanism of the MK 181 Base-Detonating fuze is similar to MK 176/178 fuze arming mechanism. The fuze is detonator-safe and is armed by sustained acceleration of approximately 20 G. This insures that the rocket will travel at least 400 feet before the fuzes arm. The maximum distance for arming is approximately 1400 feet.

WDU-4A/A FUZE (FLECHETTE)

The fuze section (figure 1-97 sheet 2) contains the same safe and arming mechanism as the MK 176 fuze, with the addition of a metal dowel press fitted into the rotor. The pin prevents a spring-loaded setback piston from moving forward and releasing the spring-loaded firing pin. The firing pin is held in place by a steel locking ball which rests in the groove of the firing pin. The ball, in turn, is held in place by a steel spacer pin which rests against the spring-loaded setback piston. This acceleration-activated arming mechanism provides a minimum 500 ft aircraft separation before the fuze arms.

When the rocket is fired the acceleration force compresses the spring of the setback piston, moving it to the rear. This action allows the rotor to move the dowel pin aft and line up the ignition train in the rotor with the firing pin. As the rocket acceleration decreases, just prior to rocket motor burnout, the spring pushes the setback piston forward, releasing the pin and ball holding the firing pin. The spring-loaded firing pin pushes the retaining ball out of the groove and fires the expulsion charge. The expulsion charge develops a gas pressure of approximately 1300 psi in the expansion chamber and forces the pusher plate, flechettes, and hemicylindrical sleeves forward, shearing the pins holding the nose plate. As the pusher plate moves forward, the flechettes and sleeves are pushed out of the main body cylinder and expelled into the slip stream ahead of the rocket. The hemicylindrical sleeves keep the flechettes from dispersing until all have been forced out of the main body cylinder.

A/B 45Y-1, Y-2, Y-4 SPRAY TANKS

The spray tanks currently available for carriage include the expendable A/B 45Y-1 (liquid agent), the reusable A/B 45Y-2 (dry agent), and the reusable A/B 45Y-4 (dry agent) low drag spray tanks (figure 1-98). The tanks are single carriage units mounted directly on the armament pylon for carriage on the outboard wing stations.

Note

> Loading configuration and authority to carry these spray tanks must be obtained from T.O. 1F-4C-1.

LIQUID AGENT

The liquid agent in the Y-1 tank is a biological agent and is considered very toxic. Information concerning safety requirements, will be supplied later.

A/B 45Y-1 LIQUID AGENT SPRAY TANK

The spray tank is basically a laminated fiberglass shell in 3 sectons enclosing a flexible bladder liquid reservoir (containing the biological agent), and a liquid control and spray system. For cold weather operations, the tank is equipped with heaters to prevent freezing of the liquid agent. The heaters are operated from external power by 115 volt ac source. The tail section of the tank has an X fin configuration.

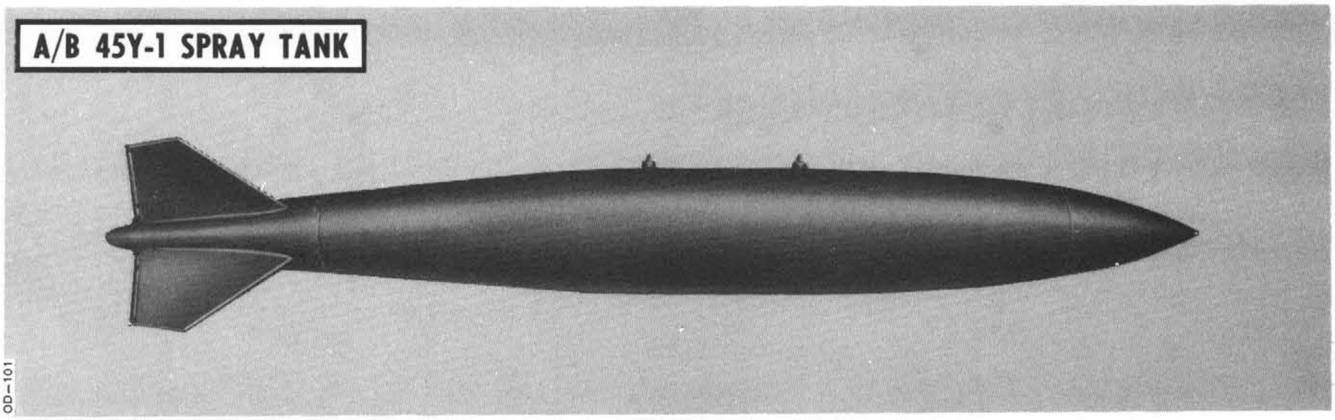
The A/B 45 Y-1 spray tank has an air storage bottle which is pressurized to 3000 psi. Discharge of an explosive squib, when the arm nose tail switch is positioned to NOSE & TAIL, sears a metal seal and pressurizes the bladder to 40 psi through a pressure regulator. When the bladder is pressurized, the tank is armed and ready for use.

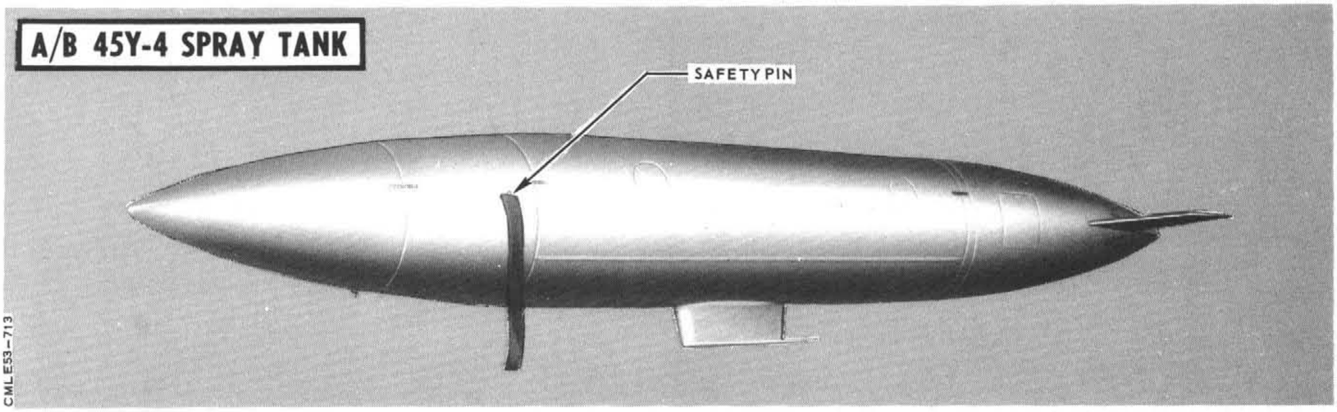
WARNING

> Once arming procedures are complete, the A/B 45 Y-1 spray tank must not be returned to home base.

Controlled dissemination is accomplished through the normal bomb release circuits of the aircraft. Approximately 3 minutes are required for complete dissemination of the liquid agent. Dissemination is controlled at the discretion of the AC by pressing the bomb release button. The AC may dispense all or part of the load. The spray is disseminated through a nozzle in tail section of the tank. The tank must be jettisoned from the aircraft after the liquid agent has been completely disseminated.

A/B 45Y-1, 2, 4 SPRAY TANKS





A/B 45Y-1, LIQUID AGENT SPRAY TANK	
DRAG INDEX	4.7
WEIGHT EMPTY	230 Pounds
WEIGHT FULL	760 Pounds
LENGTH	12 Feet, 6 Inches
DIAMETER	17.0 Inches
FIN SPAN ("X" Configuration)	32 Inches
SUSPENSION LUGS	14.0 Inches
FLIGHT LIMITS	Refer to T.O. 1F-4C-1
CAPACITY	63.5 gal - 529.0 Pounds
DISSEMINATION RATE	20 gal/min. - 166 Pounds/Min

A/B 45Y-2, DRY AGENT, SPRAY TANK	
DRAG INDEX	4.7
WEIGHT EMPTY	478 Pounds
WEIGHT FULL	552 to 784 Pounds
LENGTH	15 Feet
DIAMETER	21.1 Inches
FIN SPAN (Two; Inverted "V" Configuration)	17.7 Inches
SUSPENSION LUGS	14 Inches
FLIGHT LIMITS	Refer to T.O. 1F-4C-1
CAPACITY	300 Pounds (Maximum)

A/B 45Y-4, DRY AGENT, SPRAY TANK	
DRAG INDEX	4.8
WEIGHT EMPTY	495 Pounds
WEIGHT FULL	715 Pounds
LENGTH	14 Feet, 2 Inches
DIAMETER	20 Inches
FIN SPAN ("X" configuration)	29.5 Inches
FLIGHT LIMITS	Refer to 1F-4C-1
CAPACITY	230 Pounds

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Figure 1-98

DRY AGENT

The dry agent in the Y-2 spray tank uses a powder for anti-crop purposes. This powder is non-toxic and is not considered harmful to personnel. The Y-4 spray tank is filled with two compact dry biological agent slugs.

A/B 45Y-2 Dry Agent Spray Tank

The spray tank consists of three main sections; center, nose and tail. The nose contains a 24 volt dc battery and a 24 volt dc drive motor. The center section contains the dry agent, an internal paddle assembly which is driven by the motor, and the orifice outlet area. The nose and tail sections are connected to the center section by bayonet couplings. The tail section has an inverted V fin configuration.

Inflight operation and control of the spray tank is conducted through the aircraft conventional weapons arm and release circuits. The operating principle of the spray tank is based on the principle that dry materials flow as a fluid when mixed with flowing gas. During operation, ram air directed into the spray tank agent container mixes with the dry agent and exhausts it into the slip stream through an orifice area underneath the tank. Two circuits, the arming circuit and the disseminate circuits, are required for complete operation of the spray tank. The two circuits must be energized in proper sequence; an electrical interlock is provided in the spray tank control circuits which prevents out of sequence operation. Energizing the arming circuit, (nose tail arm switch) causes the agent container to be pressurized by ram air flow. Aircraft voltage causes the nose cover and the air inlet valve to open, thus admitting the ram air. After the agent chamber is pressurized, it is only necessary to energize the disseminate (bomb release) circuit to start delivery of the material in the spray tank. Energizing the disseminate circuit opens a discharge valve and supplies power to the motor

through a self contained battery. The AC may dispense all or part of the agent. The system may be deenergized by placing the Nose Tail arm switch to SAFE. This closes the nose cover and air inlet valve. The rate of dissemination is controlled by the orifice insert which can range in sizes up to 1 inch. The tank may be returned to base for reloading.

Note

The dry agent is non-toxic and is not considered hazardous to personnel. However, every effort must be made to properly contain the agent during operations in friendly territory.

A/B 45Y-4 Dry Agent Spray Tank

The A/B 45 Y-4 spray tank consists of three sections: nose, center, and tail. The nose section contains a nitrogen pressure supply, flow controls, and a relay system for monitoring tank functions. The nose section also has a safety switch assembly, consisting of a safety pin, housing, and switch. The function of this assembly is to render the tank safe during ground handling. Just prior to flight, the pin is removed, enabling the tank to be armed. The center section of the tank contains two agent slugs, a drive motor and an agent feed mechanism. The tail section contains a battery and speed control electronics. The tail fins on this tank are mounted in the X configuration. Dissemination of the agent is controlled through the bomb button circuits. During dissemination the drive motor moves two pistons which drive the two dry agent slugs to the center of the tank. Here, the agent is forced through two rotating disaggregator plates. These plates break up the agent which is then mixed with dry nitrogen and discharged through a ball valve. This valve is housed in an aerodynamic shroud on the bottom of the spray tank. The dissemination rate is determined by a ground setting. The agent may be disseminated at 15 to 60 pounds per minute depending upon the setting selected. When the tank is empty, the functioning is automatically stopped and an empty indication is supplied to the front cockpit. The NOSE & TAIL position on the arm nose tail switch is used to arm the tank. Continuous bomb button voltage (bomb button depressed) controls the functioning of the tank. The tank may be de-armed by positioning the arm nose tail switch to SAFE. After the mission is completed, the tank can be jettisoned or returned for decontamination and refilling as directed by the Commander.

TMU-28/B SPRAY TANK

The TMU-28/B liquid agent spray tank (figure 1-99) is suspended from the outboard armament pylons and jettisoned after dissemination of its contents is completed.

WARNING

The TMU-28/B liquid agent spray tank contains VX agent (nerve gas) which is highly toxic and can cause death to personnel.

Note

Loading configuration and authority to carry the spray tanks must be obtained from T.O. 1F-4C-1.

The spray tank has four major components: the agent container, tail cone section, hardback assembly, and dissemination nozzle (the boom). The hardback assembly has 30-inch suspension lugs and provides a surface for forced ejection of spray tank. The tail cone section is removable and contains electrical system components. The dissemination nozzle (the boom) is retracted during flight and extended approximately 30 degrees before dissemination of the liquid agent to prevent contamination of the aircraft. The agent container is used to hermetically seal the VX agent in the spray tank. During flight, the agent is released when the outlet and inlet cutters are detonated electrically, opening a hole in the aft and forward end of the container, permitting the agent to flow through the nozzle into the atmosphere.

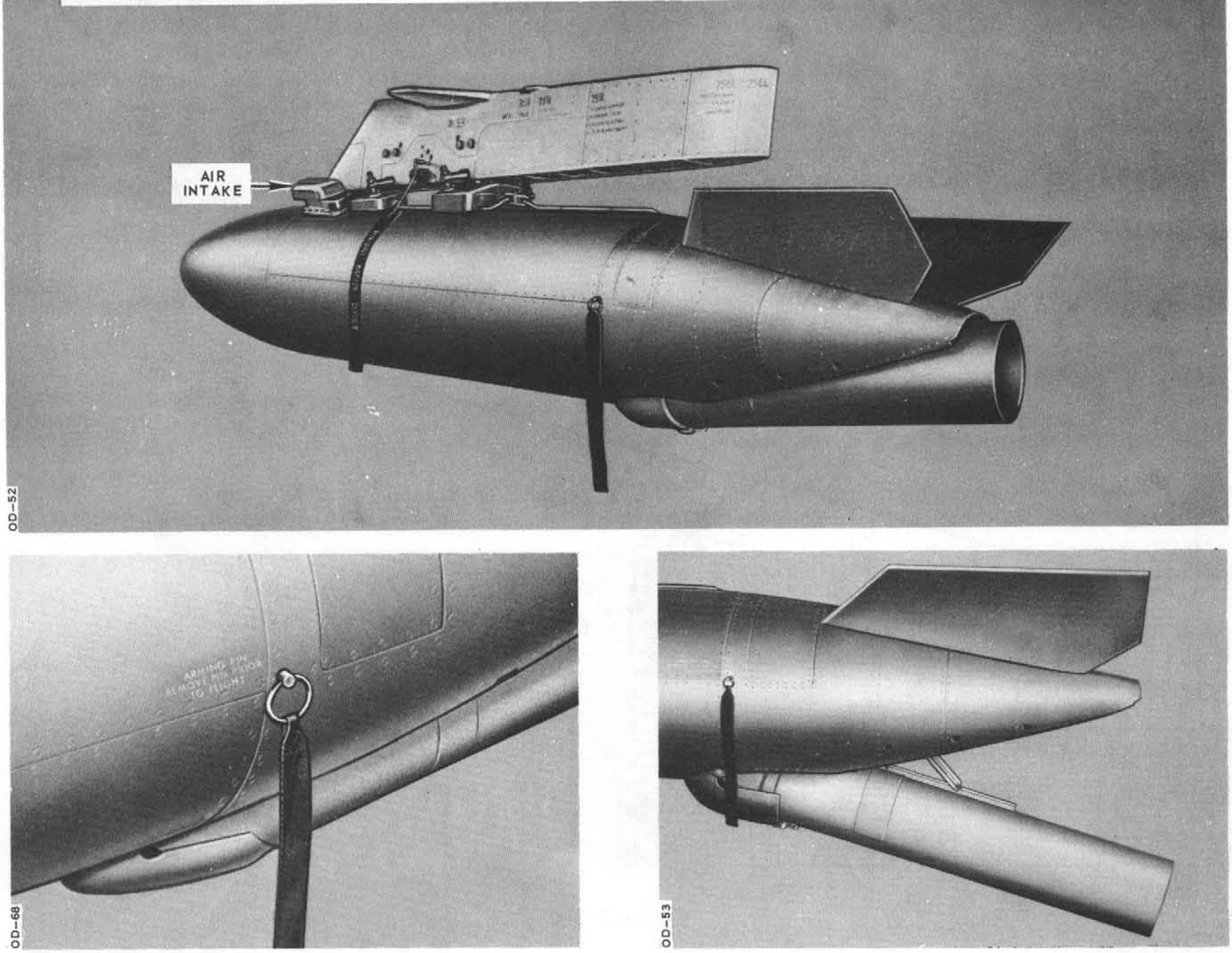
The electrical power for the spray tank electrical system is supplied by the aircraft electrical system through the umbilical cable. Electrical power activates the safety interlock switch, the extension circuit of the actuator to lower the nozzle, and fires the outlet and inlet cutters. The arming pin on the left side of the tail cone section, is inserted in the tank safety interlock switch (located within the electrical control module) to disarm the tank electrical system during ground handling. A red streamer (REMOVE BEFORE FLIGHT) is attached to the pull ring of the arming pin.

PAU-7/A SPRAY TANK

The PAU-7/A tank is a TMU-28/B spray tank (figure 1-99) modified to carry and dispense defoliant agents. The data in the paragraphs immediately above are applicable to the PAU-7/A with the following additions. The tank is reusable and may be returned to base after expending the defoliant agent. Secondly, if the boom does not extend, dissemination of the defoliant can still be accomplished. During flight, the defoliant is released when the inlet and outlet valves are electrically actuated, opening a port in both the aft and forward ends of the container and permitting the agent to flow through the nozzle into the atmosphere. The list below are PAU-7/A exceptions to the physical data shown in figure 1-99.

Weight Full	2300 pounds
Rate of Spray	6 gallons/second

TMU-28/B, PAU-7/A SPRAY TANKS



	TMU-28/B	PAU-7/A
WEIGHT	1935 Pounds	1935 Pounds
WEIGHT EMPTY	567 Pounds	567 Pounds
LENGTH	15 Ft, 5.5 Inches	15 Ft, 5.5 Inches
DIAMETER	22.5 Inches	22.5 Inches
FIN SPAN	34.9 Inches	34.9 Inches
AGENT	160.4 Gallons	160.4 Gallons
RATE OF SPRAY	20 Gallons/Second	6 Gallons/Seconds
FLIGHT LIMITS	Ref. Flight Manual	Ref. Flight Manual

4C-34-1-1-(101)

Figure 1-99

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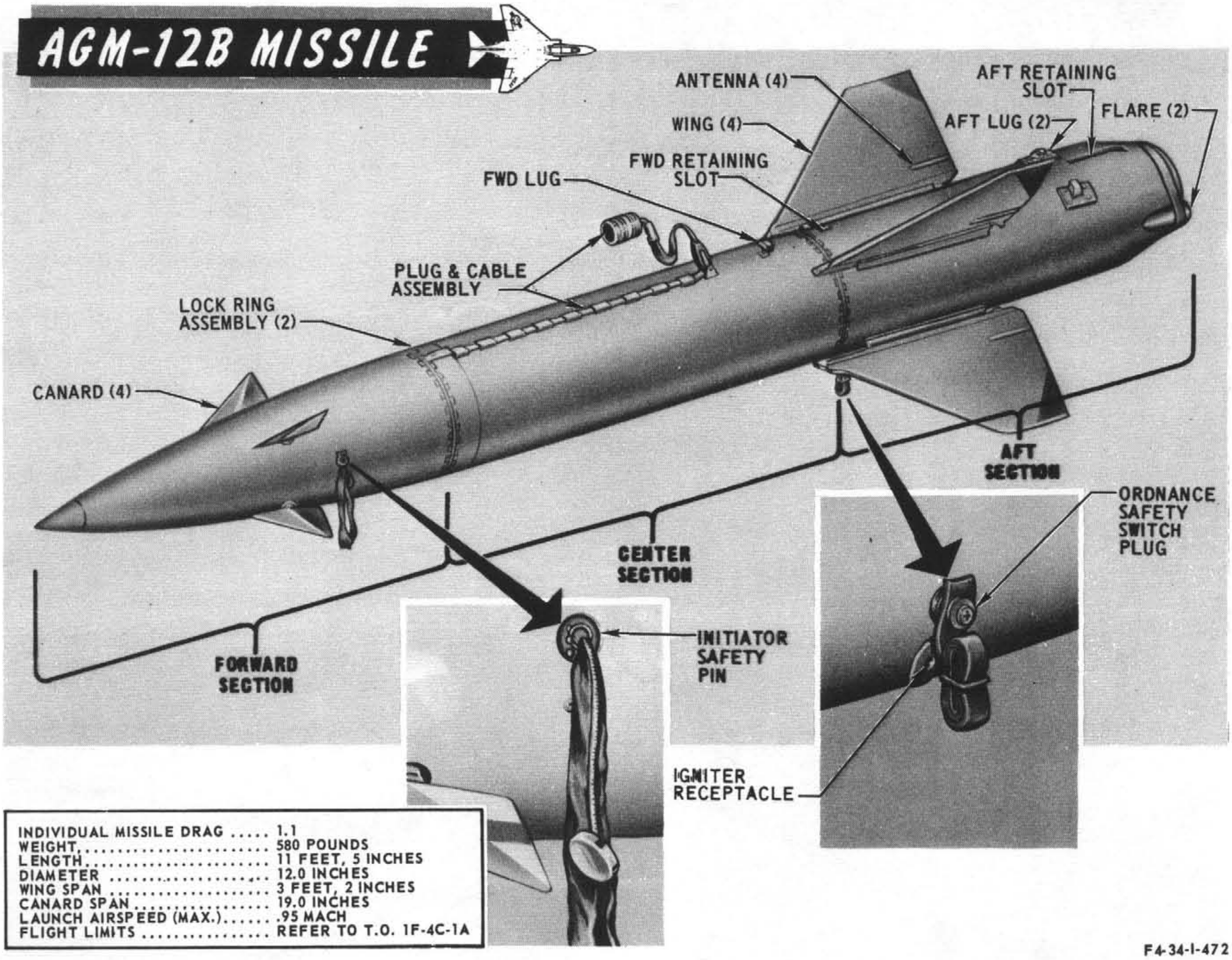

INDIVIDUAL MISSILE DRAG	1.1
WEIGHT........................	580 POUNDS
LENGTH........................	11 FEET, 5 INCHES
DIAMETER	12.0 INCHES
WING SPAN	3 FEET, 2 INCHES
CANARD SPAN	19.0 INCHES
LAUNCH AIRSPEED (MAX.).......	.95 MACH
FLIGHT LIMITS	REFER TO T.O. 1F-4C-1A

Figure 1-100

AGM-12B, -12C, -12E MISSILES

The AGM-12 series weapons are short range, radio controlled, air-to-ground missiles. Both the AGM-12B and the AGM-12C missiles are ground burst devices with either instantaneous or msec-delay fuzing options. The AGM-12C, however, is considerably heavier with a greater explosive yield (figure 1-100 and figure 1-101). The AGM-12E, which is basically the same as the AGM-12C (figure 1-101), is an air-burst device. The center section of the AGM-12E contains over 830 BLU-26/B and BLU-36/B anti-personnel bomblets. Shaped charges in the center section detonate at altitude, rupture the section, and disperse the BLU bombs over a considerable area. The following list summarizes the major components of each missile section assembly. Nearly all components are common to all three missiles.

FORWARD SECTION

Radio Guidance Receiver
Crystal Assembly
Thermal Battery
Pneumatic Control Package
Roll Reference Gyro
Canards
Elec. Plug and Cable Assembly
Fuze Triggering Device
AN/DPN-80 Radar Altimeter (AGM-12E)
Good Guidance Monitor (AGM-12E)

CENTER SECTION

Warhead
Fuze
BLU-26/B and -36/B Pack (AGM-12E)

AFT SECTION

Liquid Engine
Engine Battery (AGM-12C, -12E)
Igniter
Wings
Antenna
Tracking Flares

The following discussion of the above assemblies pertain to all AGM-12 missiles except where noted. Major differences that exist between missiles are described at the end of the discussion.

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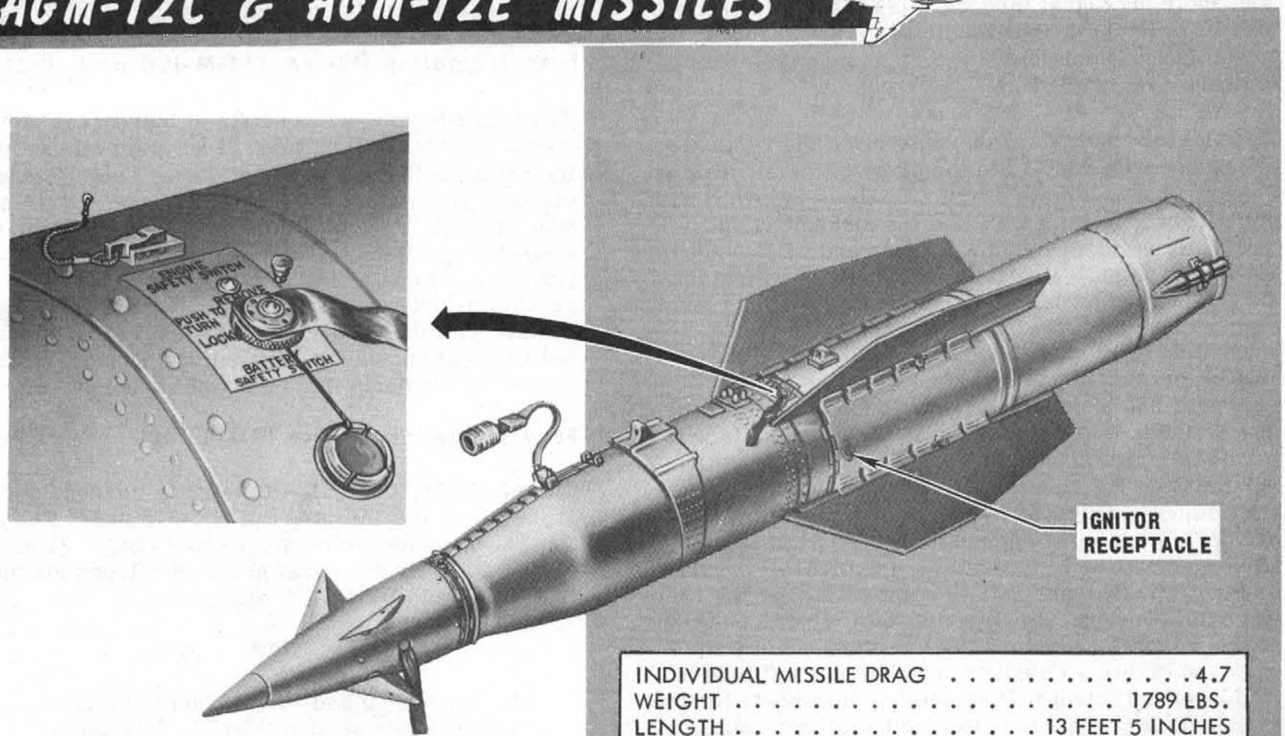
AGM-12C & AGM-12E MISSILES



INDIVIDUAL MISSILE DRAG	4.7
WEIGHT	1789 LBS.
LENGTH	13 FEET 5 INCHES
DIAMETER	17 INCHES
WING SPAN	3 FEET 8 INCHES
CANARD SPAN	24 INCHES
LAUNCH AIRSPEED (MAX)	.95 MACH
FLIGHT LIMITS	Refer to T.O. 1F-4C-1

Note

FOR AGM-12E, SUBTRACT 75 LBS FROM WEIGHT DATA SHOWN HERE. ALL OTHER DATA IS THE SAME.

F4-34-1-473

Figure 1-101

FORWARD SECTION

Radio Receiver

The missile receiver, an integral part of the command link system, is responsible for the dispersal of guidance and control signals to missile components. The unit receives the command signal generated by the AC, decodes the signal, and directs the command to the roll reference gyro. The gyro establishes a vertical reference plane for the rotating missile and essentially determines which pair of canards must be deflected for a given command. Hence, the command signal is directed from the gyro back to the receiver and on to the pneumatic control package to complete the command link. The receiver operates on one of 24 channel frequencies determined by the crystal plug-in assembly. The crystal unit, installed through an access door in the forward section, must match that of the aircraft transmitter. The receiver contains a deactivation network that prevents any transient signal from operating the canards until 0.75 sec. after launch. After launch, receiver power is supplied by the missile thermal battery.

Roll Reference Gyro

During flight, the missile is designed to roll at an angular rate of approximately 500°/sec. at minimum launch dispersion and provide inflight stability. The bent tip (AGM-12B) of each wing acts as an aileron and produces the lift force which causes the counterclockwise rotation (looking from the aft section). Hence, the gyro is provided to establish a stable, vertical reference plane within the missile, and distribute the guidance commands to those canards which will produce the required response. The spring-wound gyro is initiated as bomb button voltage melts a fusible link-releasing a lock in the gimbal and uncaging the gyro. With the gyro uncaged, the applied spring force rotates the gyro rotor to the required operating speed in a fraction of a second. Then the gyro coasts, providing control for a minimum of 30 seconds.

The decoded command input to the gyro is directed through brush contacts to four slip rings which are mounted on the roll gimbal axis. Electrically connected to the rings are two pairs of commutator segments, also mounted on the roll axis shaft. Brush

contacts at the segments pick off the command signal and apply the signal through relays that actuate the proper valve in the pneumatic system. The valve controls a pneumatic piston which physically operates the canard pair.

Note that the missile gyro establishes the vertical reference with respect to the plane of the aircraft at launch. For example, if the missile is launched with the aircraft in a left bank and the aircraft is subsequently rolled level, an up command will result in an up-left missile response. Thus, the attitude must be established at missile launch with the wings level. Considering the missile command link functions discussed in other parts of this manual, a time lag of one-tenth of a second exists between the receipt of the command signal and the response of the canards. In one-tenth of a second, the AGM-12B missile will rotate 50° counterclockwise. Without compensation for the time lag, the missile would respond in a direction 50° counterclockwise from the intended command i.e., and up command would result in up-left missile movement. Therefore, the pick-off brushes in the gyro are biased 50° to compensate for the time lag. However, the missile will enter flight conditions where roll rate will deviate from the designed 500°/sec. and create a situation in which pick-off bias is no longer sufficient to completely compensate for the command lag. This is called roll reference shift. A further discussion of roll reference shift is provided in the previous part of this manual.

Pneumatic Control Package

The pneumatic control system provides the motor force that deflects the canards. The package contains tubular shafts that receive the canards through the missile skin. A rotational force at the shafts, applied through mechanical linkage by pneumatic pressure, deflects the canards each time a command signal is applied. The linkage system is spring-loaded to the neutral position and with each command, the canards deflect in one direction to full travel. The pneumatic supply bottle is precharged to 3000 psi with dry air or nitrogen, and supplies the required control pressure for a minimum of 30 seconds. At launch, bomb button voltage energizes a squib-actuated initiator valve, which releases bottle pressure to charge the system. The initiator safety pin (figure 1-101) opens the circuit to the squib explosive switch so that the squib cannot fire during ground operations.

Thermal Battery

The missile battery is inert until the AC applies launch power through the bomb button. This ignites squibs which dump electrolyte fluid into the battery plates - activating the battery within 1.5 seconds. Battery power then energizes a relay in the launcher, which closes the circuit between the bomb button and the liquid engine ignitor. The entire missile firing sequence requires approximately 2.0 seconds. The AC must hold the bomb button depressed until the firing sequence is complete and the missile leaves the launcher. After launch, the battery powers the missile receiver, the canard solenoid relays, and the fuze. The battery will maintain the required power output for a minimum of 30 seconds.

Fuze Triggering Device (AGM-12B and -12C)

The triggering device consists of four linear elements (coaxial rods) spaced at 90° intervals around the inside of the forward section, and one circular element around the inside circumference of the section. Each rod element contains an inner electrical conductor insulated from grounded castings positioned at various points along the elements. At ground impact, the castings are crushed, making contact with the conductor. This completes the warhead circuit and causes detonation. Damage to any one of the elements will close the fuzing circuit.

Fuze Triggering Device (AGM-12E)

The AN/DPN-80 Radar Altimeter in the nose section of the AGM-12E initiates the MK-312 fuze. The altimeter operates within a specified range, which includes all desirable burst height envelopes for the BLU-26/B and BLU-36/B dispersion.

Note

The BLU-26/B and -36/B bomblet is discussed in this section, part 4. See figure 1-86.

The desired burst height is preset through a dial on the top right side of the nose section. During missile flight, the altimeter system senses the altitude of the missile, relates this to the preset altitude, and closes the missile fuzing circuit when the two match. The fuze trigger signal causes the MK-312 fuze to detonate shaped charges which sever the center section skin. As the skin panels separate and move outward into airstream, the nose section is freed and the bombs are dispersed over the target area.

Note

Further information covering AGM-12E flight parameters and fuzing system is contained in T.O. 1F-4C-34-1-1A, section 4.

CENTER SECTION

Warhead and Fuze (AGM-12B and -12C)

The center section encloses the semi-armor-piercing, cartridge-type warhead containing the high explosive. The fuze, which is attached to the aft end of the warhead, is electrically grounded and mechanically safe until launch. Forces applied to the missile during the acceleration and deceleration phases of missile flight mechanically arms the fuze and removes the electrical ground - eliminating the last safety device in the fuze circuit. Hence, final fuze arming cannot occur unless engine thrust is delivered. After launch, a capacitor in the fuze is charged by the missile battery. At impact, the fuze triggering device completes the warhead/capacitor circuit, which discharges the capacitor and initiates

the explosive train. Tumbler switches, which are energized by the force of impact, are provided to close the capacitor circuit as a back-up method in case the fuze triggering device fails. Armament crews can preset the fuze for an instantaneous burst, or for a delayed burst (0.008 sec). For targets of heavy structure, the delayed fuze will probably provide best results.

The center warhead section of the AGM-12E is an aluminum shell containing a mixed load of over 830 BLU-26/B and -36/B bomblets. Preliminary information regarding bomblet dispersion characteristics is available in T.O. 1F-4C-34-1-1A.

AFT SECTION

Liquid Engine and Tracking Flares

The liquid engine contains an oxidizer tank and a fuel tank, each hermetically sealed and mounted in tandem. A solid propellant gas generator, which is initiated by the fire signal, provides the pressure required to break the seals on the propellant tanks. As the oxidizer and fuel mix, they ignite spontaneously and produce the required thrust. More important to the aircrew, however, is the installation of the live igniter in the engine section (figures 1-100 and 1-101). The bayonet-type igniter must be installed to begin the engine ignition sequence. The igniter is electrically fired to ignite a booster charge, which in turn ignites the gas generator mentioned above. Removal of the igniter renders the engine safe during ground operations and storage. On the AGM-12B, a red-flagged shorting plug - a ground safety device - is installed immediately next to the igniter receptacle to electrically safe the ignition circuit while the igniter is installed. The tips of the tracking flares extend into the engine exhaust area, and are ignited by the hot engine gases. The flares burn for a minimum of 32 seconds, increasing in intensity after 9 to 12 seconds burning time.

AGM-12C AND -12E MISSILE

The above discussion points out that the missile rolls at an average angular rate during flight. The AGM-12C/E missile wing mounts are designed so that the plane of the wings is one-half degree from longitudinal centerline - causing the roll force. The actual mean roll rate, and the extent of roll reference shift, is expected to be about the same as the AGM-12B.

In the AGM-12C/E missile, there are actually two power supplies: The forward battery (in the nose section) supplies voltage to operate the missile systems. The engine battery, located directly under the battery safety plug assembly, supplies voltage to the engine igniter. Both batteries are activated as the pilot depresses the bomb button. The safety switch assemblies are described below.

As far as the aircrew is concerned, the missile firing sequence is the same for either missile. Additional safety devices are in the AGM-12C/E firing circuit, however, that must be checked during pre-flight operations. These are the battery safety switch plug and engine safety switch lever shown in figure 1-101. The battery safety switch plug assembly is installed during ground operations. When installed, the unit opens the circuit between the missile engine battery and the engine ignitor. (The bayonet-type ignitor location is also shown in figure 1-101.) The battery plug must be removed before flight. The engine safety switches, held open by the lever assembly on the top of the missile, also locks out the ignitor/battery circuit. The attached lanyard is hooked onto the armament pylon during loading operations. As the missile is ejected, tension on the lanyard closes the switches and eliminates the last interlock between the missile battery and engine ignitor. Hence, engine firing occurs shortly after ejection.

LASER GUIDED BOMBS (MK 82, 84, M118)

EQUIPMENT CONFIGURATION

The MK 84 weapon system consist of the MK 84 GP bomb and the KMU-351/B bomb guidance kit. The bomb guidance kits and associated attaching hardware provide a laser, terminal guidance capability for the MK 84. No specific carriage equipment or weapon fire control system is necessary; the weapon is mounted directly on the wing station armament pylons and released through the conventional weapons controls. No electrical connectors exist between aircraft and weapon. Hence, weapon monitoring or controlling functions are not required from the cockpit. Figure 1-102 shows the complete assembly of KMU-351/B kit components mounted on the MK 84 LDGP bomb.

The M118 system consists of the M118 GP bomb and the KMU-370/B bomb guidance kit. The guidance system used with the M118 is essentially the same as the one used with the MK 84. See figure 1-103.

The MK 82 HS (high speed) components consist of the MK 82 GP bomb and the KMU-388 bomb guidance kit. This weapon system performs the same mission functions as those above, and the guidance unit is essentially the same (figures 1-102 and 1-103). However, the MK-82 system may be carried on MER/TER shoulder stations, and the MER/TER equipment is modified to provide specific release sequencing. (Further information will be supplied when available.)

Note

Ballistics and weapon envelope/profile data is available for the laser weapons in T.O. 1F-4C-34-1-1A, section VI.

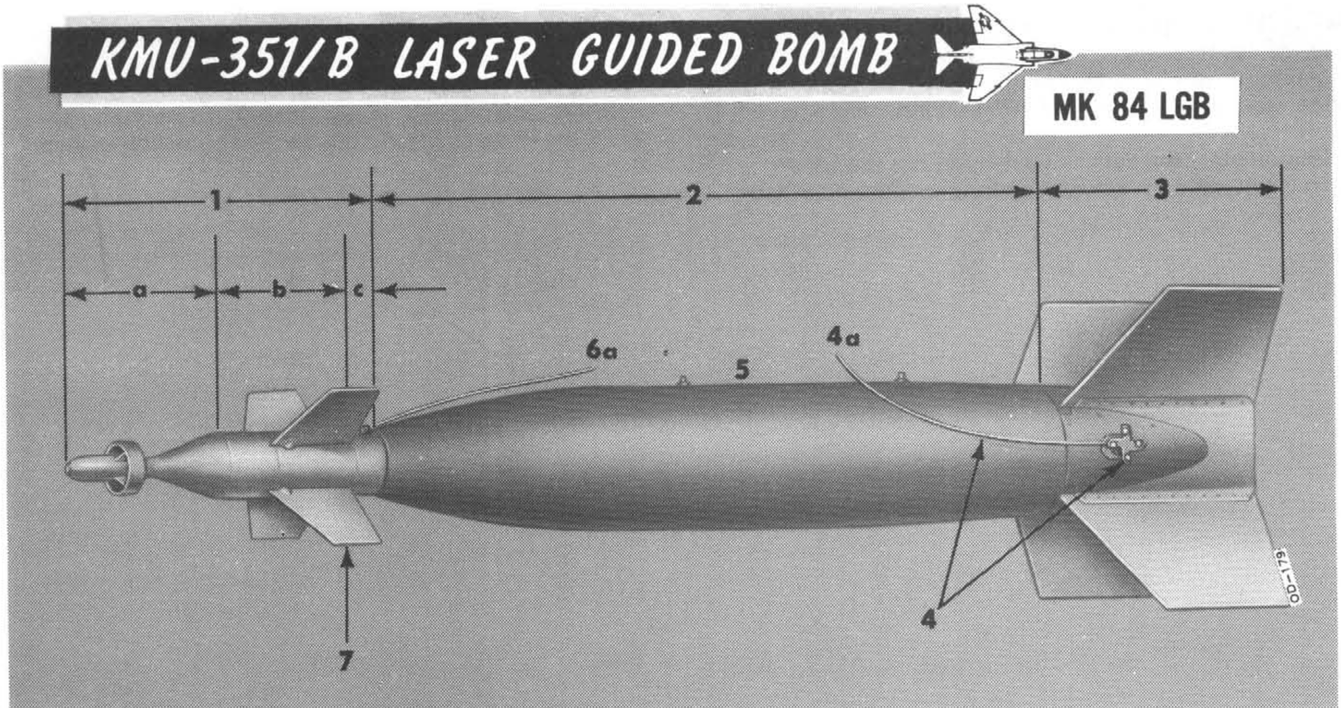
MISSION

The delivery aircraft uses the laser guided bomb in much the same manner as conventional unguided bombs in support of air operations including air superiority, interdiction and close air support missions. Targets illuminated by a laser are attacked

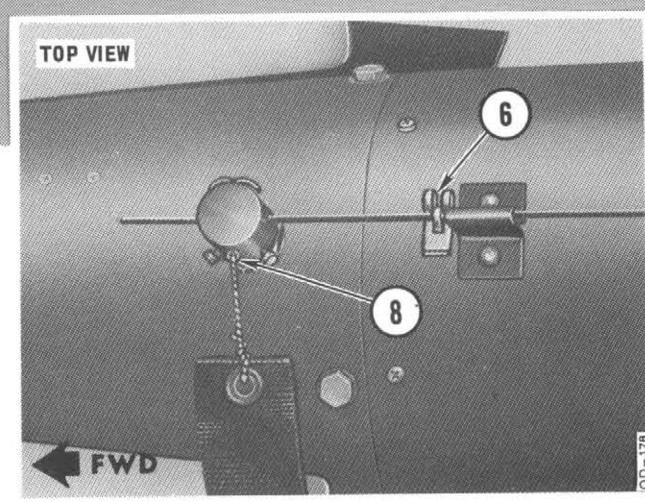
using this system. The bomb guidance system, sensing the laser energy, derives azimuth and elevation steering commands for the movable canards to provide steering to the illuminated target.

Mission planning data is presented for the level, dive, loft, and dive-toss bombing modes. The mission may therefore be conducted against targets of opportunity, or against pre-planned targets of known location. The ballistic tables, for all modes, assume that the weapon flies an unguided (ballistic) path toward the target. Thus, the weapon guidance system

R.11



DRAG INDEX	4.6
WEIGHT	2052 Pounds
LENGTH	14 Feet
BOMB DIAMETER	18.0 Inches
FIN SPAN	25.3 Inches
WING SPAN	45.0 Inches



1. KMU-351/B:
   a. Laser Illumination Detectors
   b. Bomb Guidance Computer and Control Section
   c. FMU-26B/B Fuze and Forward Fairing Assy
2. MK-84 Bomb
3. KMU-351/B Wing Assembly
4. ATU-35 Drive Assembly (M905 Tail Fuze)
   a. Arming Wire to Tail Solenoid
5. FMU-26B/B or FMU-72/B Battery Initiator Lanyard Connected to Center Solenoid
6. Battery Arming Wire
   a. Arming Wire Tied to Sway Brace
7. Canards
8. Thermal Battery Firing Device Safety Pin

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Figure 1-102

must accomplish only final course corrections. By this procedure, the weapon should impact close to the target if the guidance system malfunctions. Guidance system acquisition of the target prior to release is unnecessary. The weapon flies ballistically until the illuminated target is within the detector field of view and until the reflected energy is strong enough to activate the guidance system.

LASER GUIDED BOMB

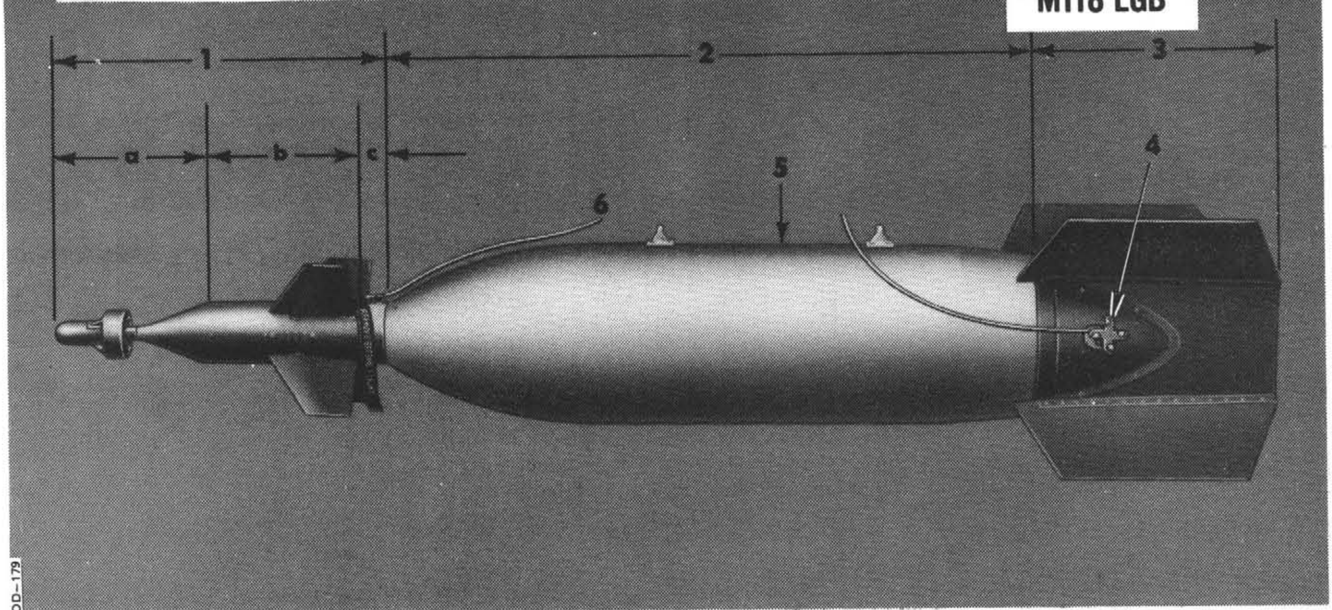
The MK 84 and M118 bombs are shown in figures 1-102 and 1-103 with their respective guidance kits. The guidance systems are mounted on the weapon to become the extreme forward and rear sections. The major components of the guidance kits are the laser illumination detector, the bomb guidance control, and the wing assembly.

LASER ILLUMINATION DETECTOR

This section (figure 1-102) consists of an IR dome, the optical equipment, an infrared detector, and the signal mixer and preamplifier networks. The detector housing is gimbal-mounted by a universal joint assembly. During bomb flight, the detector bore-

KMU-370/B LASER GUIDED BOMB

M118 LGB



1. KMU-370/B:
   a. Laser Illumination Detector
   b. Bomb Guidance Computer and Control Section
   c. FMU-26 B/B Fuze and Forward Fairing Assy
2. M118 Bomb
3. KMU-370/B Wing Assembly
4. ATU-35 Drive Assembly (M-905 Tail Fuze)
   a. Arming Wire to Tail Solenoid
5. FMU-26 B/B Battery Initiator Lanyard, Connected to Center Solenoid
6. Battery Arming Wire Tied to Sway Brace

DRAG INDEX.	8.2
WEIGHT.	3066 Pounds
LENGTH.	13 Feet, 9 Inches
BOMB DIAMETER . . .	24.13 Inches
FIN SPAN	48.00 Inches
WING SPAN.	68.00 Inches

4C-34-1-1-(105)

Figure 1-103

sight axis is maintained along the bomb velocity vector by the ring stabilizer. The four-quadrant detector receives invisible laser energy in the near infrared spectrum. This in turn generates signals with characteristics that are a function of the detector quadrant or quadrants receiving the energy. These signals, which eventually become both pitch and yaw commands, are directed to the guidance computer.

GUIDANCE COMPUTER

The computer receives the detector signals and performs the electronic processes which develop the command signals and operate the guidance control unit. Some of the computer components include the log amplifier, comparator logic, and the control logic circuits. The amplifier video processing circuits amplify the weak (long range) video signals and attenuate the strong (close range) ones in direct proportion to the strength of the signals. This enables the continuous detection of both weak and then very strong signals by the same system. The comparator network - receiving the output of the amplifier - develops the error signals which represent the direction (left or right, up or down) to be taken to correct weapon flight. Then the control logic converts these error signals into solenoid drive signals, which in turn operate the proper set of steering solenoids. The control logic also contains circuits which place the commands in a fin trail status if guidance signals are lost or if signal inputs are of insufficient strength.

BOMB GUIDANCE CONTROL

This section of the KMU system consists of the four movable canards, four solenoids, the thermal battery, and a gas generator. These units provide the drive force which moves the canards in accordance with the commands generated by the computer. Each canard pair, which shares a common shaft, is driven in a bang-bang manner to a total of 5.5° movement in either direction. In the absence of any command, the canards are maintained in the trail position by the airstream.

The thermal battery firing device in the top of the control unit receives the battery arming wire. The wire is routed through the forward bomb lug and tied to the forward rack sway brace. Guidance is always activated at release. As the weapon separates from the rack, the arming wire is pulled activating the thermal battery. Battery voltage is applied to a 3-second delay squib relay; when the relay fires, the bomb power systems are activated. The 3-second

delay allows the bomb and aircraft to separate sufficiently before any guidance commands can begin.

FORWARD FAIRING ASSEMBLY

The forward fairing assembly provides the mounting and interfacing structure between KMU guidance kit and the bomb. The FMU-26 electrical fuze is installed through the adapter fairing and into the nose fuze well of the bomb. This is an electrical fuze with a self contained thermal battery. A fuze arming lanyard is routed internally through the bomb, extended through a lanyard access between the bomb lugs, and fized in both the center and forward arming solenoids of the MAU-12 rack. At bomb release, pulling the lanyard initiates battery operation. (FMU-26 fuzes are further described in this section, Bomb Fuzes.)

GUIDED BOMB WING ASSEMBLY

The KMU wing assembly provides the necessary lift for bomb maneuvering flight. Access ports in the wing fairing provide mounting points for ATU-35 drive assembly, which drives the M-905 bomb tail fuze. The ATU-35 drive receives a branched arming wire which is fixed into the center arming solenoid of the bomb rack. Both the fuze and the drive unit are described in this section, Bomb Fuzes.

BOMB FUZES

A fuze is a device used to initiate bomb detonation at a predetermined time, and under the desired circumstances. Since targets are usually selected in advance of a mission, and the structure of the target indicates the type of fuzing which would produce the best results, it is imperative that the correct fuzing system be installed in the weapon. Additionally, many weapons can accommodate a large variety of fuzes which can drastically change the effects. All tactical fighter pilots must be familiar with the classification and operation of fuzes to effectively plan the mode of delivery and insure safe escape from the contemplated weapon effects. Refer to Bomb/Fuze compatibility, figure 1-103A

WARNING

- Restricted fuzes and weapons within various lots are identified and kept current in T.O. 11A-1-1, Ammunition Restricted or Suspended.
- Improper employment of a weapon fuze combination may result in serious damage to the aircraft or injury to the aircrew.

Note

For Fuze Safe Arming Times, refer to section IV, and section VI, table of contents.

CLASSIFICATION OF BOMB FUZES

Bomb fuzes may be separated into two general classifications (refer to figure 1-104):

a. LOCATION. (1) nose fuze, or (2) tail fuze, bomb fuzes are installed in the nose and/or tail of the bomb. Nose and tail fuzes usually are not interchangeable because of differences in arming devices and internal operation. Some fuzes, such as the FMU-7 series bomb igniter fuze, arm by falling with either end of the bomb toward the direction of fall and function at any angle of impact. This type can be used in either the bomb nose or tail.

b. ACTION. The means of functioning or detonating the bomb may place the fuze in one of the following classes:

(1) IMPACT FUZES: Impact fuzes function upon impact with the target or with a short delay. In this type, the time delay (if any) is measured from the instant of impact, depending upon the type of explosive train employed: delay or non-delay.

(2) TIME FUZES: In a time fuze, the delay is initiated at bomb release from the aircraft - not at the instant of impact. The time element is obtained by a mechanical or electrical device. An example of this type of fuze is the M907 time fuze.

(3) PROXIMITY FUZES. The proximity fuze is actually a combination radio broadcasting and receiving station. The waves, which are constantly being broadcast by the fuze at a set frequency, are reflected back from the target and picked up by the receiving set in the fuze. When this picked-up impulse is of sufficient magnitude, an electronic device actuates an electric detonator. This fuze functions when it comes in proximity to any target capable of reflecting its waves. The proximity distance can be controlled during manufacture. An example of this type of fuze is the FMU-56/B, A/B, B/B.

Fuzes are further classified by the method or arming and the type of explosive train employed.

METHOD OF ARMING

Fuzes are armed after bomb release, in one (or a combination) of four methods:

a. VANE. The arming-vane type has a propeller or anemometer which is rotated after release by air flowing past the falling bomb. When the vane has rotated the required number of times, the fuze is armed. An example of this type of fuze is the M904 nose fuze.

b. PIN. The arming-pin type fuze has a pin or plunger which is ejected or withdrawn by spring action when the bomb is released. The ejection of the pin releases the arming mechanism and allows the fuze to arm, such as the M909 time fuze.

BOMB/FUZE COMPATIBILITY

WARNING

Refer to T.O. 11A-1-1, Ammunition Restricted or Suspended, for current information reguarding restricted use and unsafe types or specific lots of ammunitions, fuzes and air munitions whose performance or safety for use is questionable.

	BOMB																					INITIA-TORS	FUZE	IGNI-TORS					ATU-35/B COUPLER			
FUZE	BLU-1/B Fire Bomb	BLU-1B/B Fire Bomb	BLU-1C/B Fire Bomb	BLU-27/B, A/B Fire Bomb		Laser Guided Bomb MK 84	Laser Guided Bomb M118	MC-1 Gas	MK82 LDGP	MK 82 Snakeye	MK 83 LDGP	MK 84 LDGP	M36E2 Incendiary	M117 GP	M117 Retarded	M118 GP	M129 E1, E2 Leaflet	ROCKEYE II	SUU-30/B, A/B, C/B Dispenser	SUU-30B/B Dispenser		FMU-7A/B, B/B	M1 and M1A1 Fuze Extenders	M23 or AN-M23A1						MAU-87/B Governed		
AN-M47A1(MT) Nose																	X															
ATU-35/B, A/B Arming Dr. Assy.						X	X	X	X		X	X		X		X														X		
FMU-7/B, A/B, B/B, C/B Elec. Nose & Tail	X	X	X	X																		X		X								
FMU-26B/B Elec. Nose and Tail						X	X		X		X	X		X		X				X												
FMU-54/B and 54A/B Tail										X					X																	
FMU-56/B, A/B, B/B Proximity Fuze																				X												
FMU-72/B Elec. Nose and Tail						X			X		X	X		X		X																
MK 339 (MT) Nose																		X														
M1 and M1A1 Fuze Extenders									X		X	X				X																
M152 A1 (MT) Tail													X																			
M904 E1, E2 and E3 Nose								X	X	5	X	X		X	5	X							X									
M905 Tail						X	X	X	X		X	X		X		X														X		
M907 (MT) Nose																			X	7												
TAIL FIN CONFIGURATIONS																																
1 FIN CONFIGURATION								2			4			2	3		2															
NO FINS	6	6	6	6																												

Notes

1. All fin configurations are X except as noted.
2. Aircraft stations 1 and 9 on MER stations 3 and 5 require + (plus) fins.
3. Aircraft stations 2 and 8 on TER station 1 require + (plus) fins.
4. All stations require + (plus) fins.
5. M904 E2 or E3 nose fuze only.
6. Optional
7. Physically compatible but not reliable and should not be used.

4C-34-1-1-(66)

Figure 1-103A

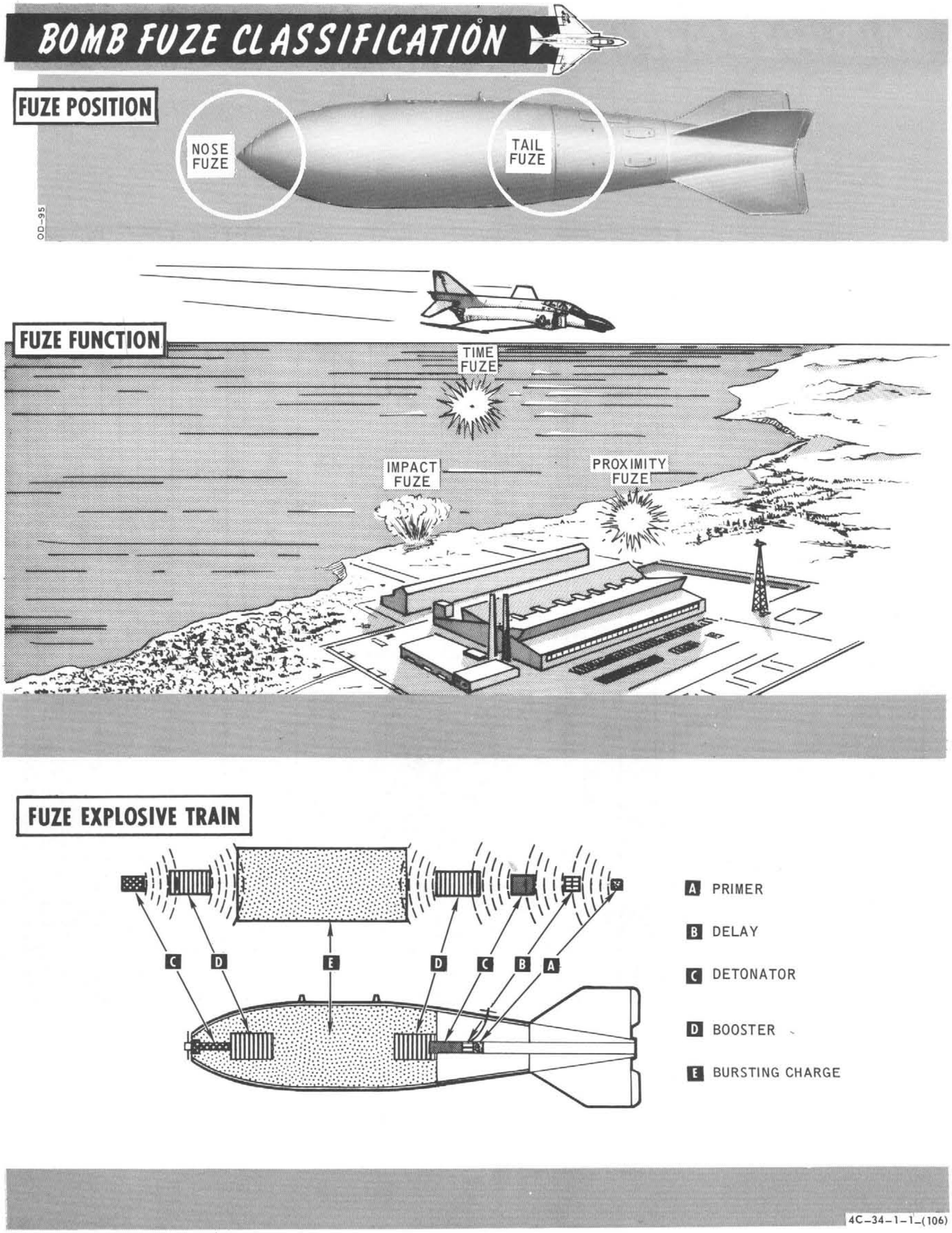

BOMB FUZE CLASSIFICATION
FUZE POSITION
NOSE FUZE
TAIL FUZE
OD-95
FUZE FUNCTION
TIME FUZE
IMPACT FUZE
PROXIMITY FUZE
FUZE EXPLOSIVE TRAIN
C
D
E
D
C
B
A
A PRIMER
B DELAY
C DETONATOR
D BOOSTER
E BURSTING CHARGE
4C-34-1-1-(106)

Figure 1-104

c. INERTIA. The inertia-arming type is armed by an abrupt change in the velocity of the falling bomb.

d. ELECTRIC. The electrical-arming type fuze is armed by a battery which is activated at bomb release by the extraction of an arming lanyard, such as the FMU-7 series fuze used with BLU-1/B fire bomb.

Arming Time Interval

Both arming-pin type and arming-vane type fuzes are further classified according to arming-time interval - direct-arming or delayed-arming.

a. DIRECT-ARMING. A direct-arming fuze is armed immediately when the arming pin is ejected or when the arming vane has rotated the required number of revolutions.

b. DELAYED-ARMING. The delayed-arming fuze has an arming pin or arming vane which operates as in the direct-arming fuze, but instead of arming the fuze directly, the mechanism (controlled by the pin or vane) initiates a powder train or clockwork mechanism which arms the fuze after a predetermined time has elapsed, such as the M900 series fuzes.

EXPLOSIVE TRAIN

An explosive train controls the functioning (detonation) of the bomb (figure 1-104). A train is a sequence of explosions in which a small quantity of a very sensitive explosive ultimately sets off a large quantity of a much less sentitive explosive. The two basic explosive trains are the propelling charge and the bursting charge as contained in bombs. The type of explosive used in such large quantities as in the loading of bombs must be relatively insensitive to shock and heat. It provides a reasonable degree of safety in storing, shipping and handling; allows the bomb to be dropped safe over friendly territory; and permits the bomb to be used to penetrate a resistant target such as armor plate, earth, or concrete, before exploding. On the other hand, the type of explosive used in the fuze must be very sensitive so it will be sure to explode when impacted by the firing pin. Such an explosive is not safe to handle except in minute quantities, and, therefore, is strongly compressed into a metal capsule called a detonator which is built into the fuze. The shock generated by the explosion of a detonator is not sufficiently strong to be reliable as a means of exploding the large amount of insensitive explosive which makes up the main charge of the bomb; therefore, a small quantity of explosive, which is more sensitive than the main charge, is placed next to the detonator; this element is called the booster. The booster is sensitive enough to be exploded by the detonator and large enough so that the shock of its explosion will explode the bursting charge (or main charge) of the bomb. Such an arrangement of elements is called the explosive train, and is the basic method of operation in all explosive ammunition.

Types of Explosive Trains

The explosive train operation, in both nose and tail fuzes, may be instantaneous or delayed action.

a. Instantaneous operation begins immediately upon weapon impact with the target when the firing pin is driven into the detonator (approximately the size of an aspirin tablet). The blast from the detonator explodes the booster (about the size of a flashlight battery) which relays and amplifies the blast, causing the bursting charge to explode.

b. A delayed action train may be necessary to allow bomb penetration of a target or to permit the low altitude delivery aircraft to escape from the target area. This action requires two additional components - a primer and a delayed element - which are placed ahead of the detonator, booster, and main charge. In this arrangement, the action begins as a detonation but is converted into a delaying flame by the delay element. The detonator again changes it into a detonation which continues through the booster and into the bursting charge.

SAFETY FEATURES

For safety reasons, a bomb must be incapable of exploding through premature or accidental fuze action, before it is clear of the aircraft. By definition, a fuze is armed when the next normally expected event will initiate a function of the fuze. As previously discussed, that event may be impact, time train running to completion, nearness to the target, or water pressure. As shipped, fuzes are in a safe (unarmed) condition. They are so constructed that while unarmed they cannot function. To prevent premature or accidental functioning of a fuze, a safety feature is incorporated when it is manufactured. The most common safety feature in fuzes includes detonator-safe, arming-stem-safe, and safety-block-safe devices.

a. A detonator-safe arrangement in a fuze holds one of the explosive train elements out of alignment with the other elements. For example, the detonator may be held out of line with the firing pin until the fuze is armed.

b. A safety feature commonly found in tail fuzes is an arming stem which is crewed into the firing pin plunger. In this type of fuze, the detonator is located immediately beneath the firing pin. Arming of the fuze withdraws the arming stem from the firing pin plunger, thus freeing the plunger. An anti-creep spring prevents premature movement of the plunger.

c. The safety-block safe feature, commonly found in nose fuzes, consists of a ring of small steel blocks which are located between the striker and the fuze body, thus preventing the firing pin from contacting the primer or detonator. The arming vane drives a gear train which, after a definite interval, permits the safety blocks to be ejected.

ARMING WIRE/LANYARD ROUTING

The authorized arming wire/lanyard routing is presented in the Conventional Munitions Loading Procedures T.O. 1F-4C-33-1-2. The equipment used to initiate fuze arming and weapon operation varies with the weapon and mission requirement. Figure 1-105 shows the arming wire, arming lanyard, and fin release lanyard routing that provides the aircraft commander with the option to release the MK82 Snakeye or M117R bombs either high drag or low drag.

Note

After T.O. 1F-4-805, the arm nose tail switch positions are SAFE, NOSE, TAIL, and NOSE and TAIL.

The arm nose tail switch on the multiple weapons control panel controls voltage application to the selected solenoid(s) in the bomb rack. The switch therefore determines which of the bomb fuze arming wires are released with the weapon or retained by the solenoid. When a bomb is released ARMED, the arming wire swivel loops are retained by the arming solenoids. As the bomb is ejected from the bomb rack, the arming wires are pulled from the fuzes, through the swivel loops, and remain attached to the bomb lugs. The fuzes are then free to become armed or to operate. If the NOSE option is selected, the nose fuze functions as described and the tail arming solenoid releases the swivel loop; the tail fuze arming wire and the swivel loop remain with the bomb. If the bomb is released SAFE, both arming wire swivel loops are released from the arming solenoids, the arming wires remain in the fuze safety devices and the fuzes cannot function. Without fuze operation, the bomb is expected to dud.

ARMING WIRE ROUTING FOR HIGH LOW DRAG INFLIGHT OPTION

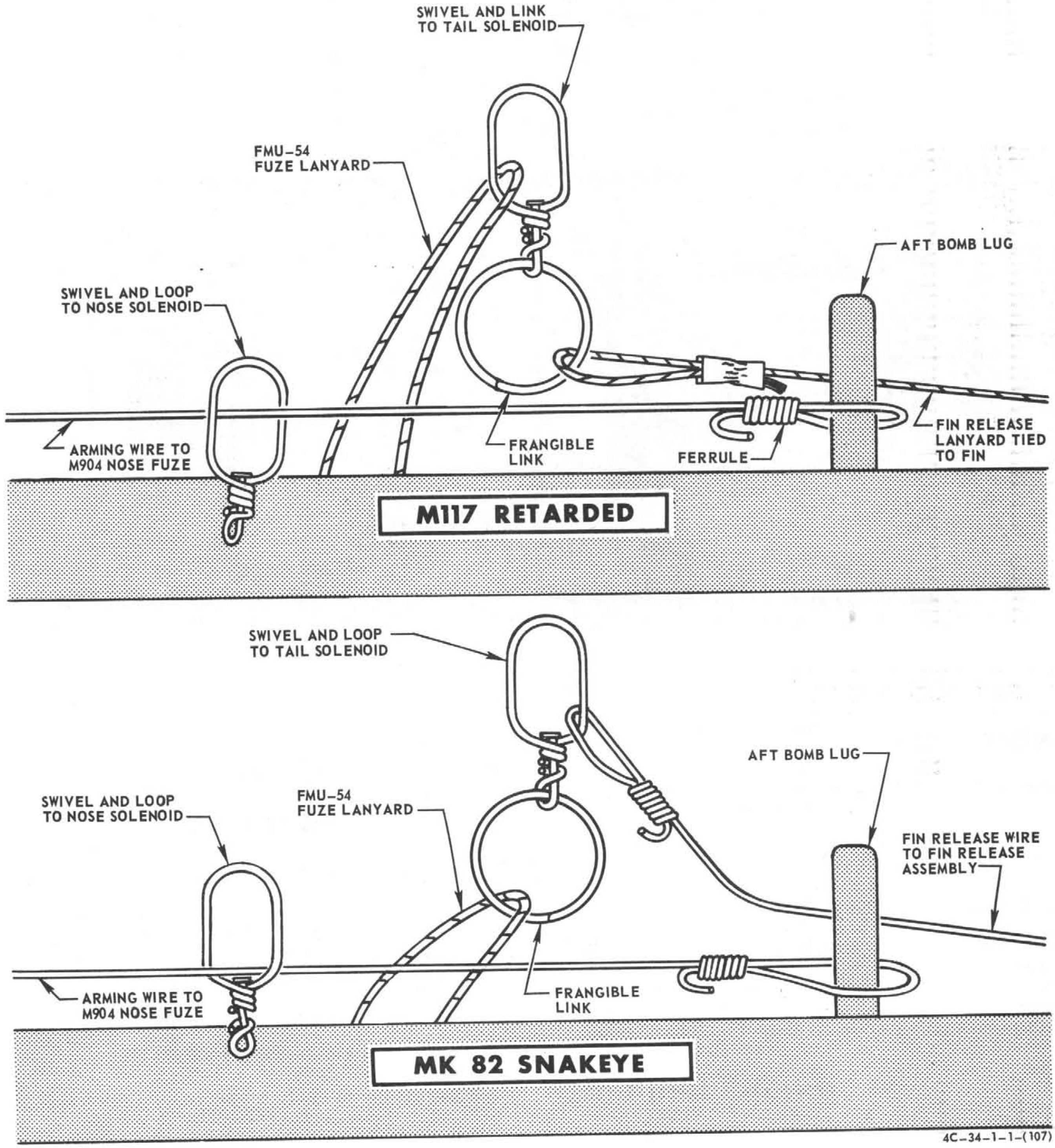


Figure 1-105

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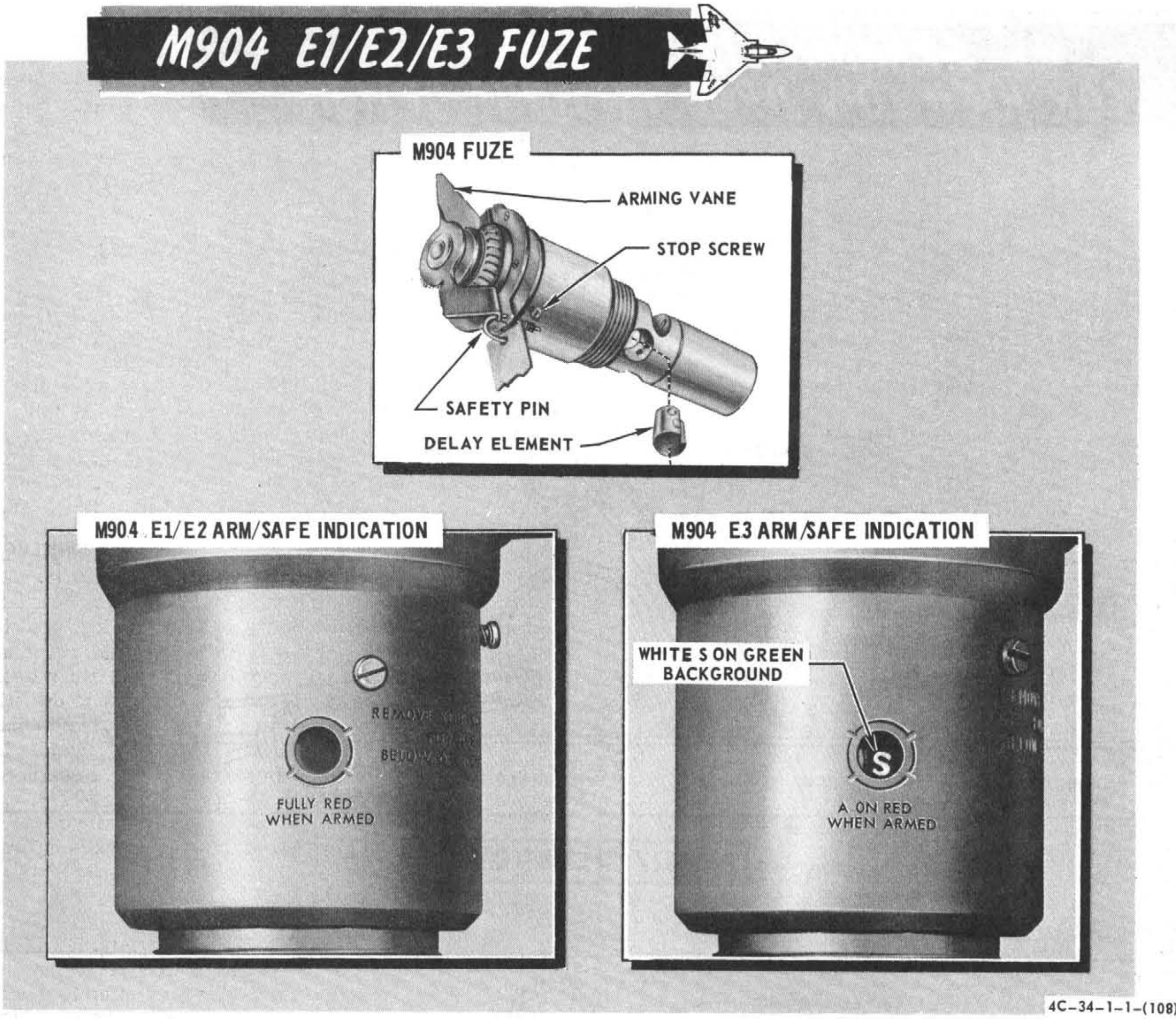

Figure 1-107

NOSE FUZES

MK 339 MOD 0 MECHANICAL TIME NOSE FUZE

Refer to MK 20 Mod 2 and Mod 3 cluster bomb this section.

M904E1/E2/E3 NOSE FUZE

The M904 (figure 1-107) is a mechanical impact nose fuze commonly used with general purpose bombs. It is approximately 9-1/3 inches long and 2 inches in diameter at the fuze threads. The desired arming time is set on a calibrated dial. The selective delay times for M904E1 are: 4, 6, 8, 12, 16 and 20 seconds. The M904E2/E3 has the following delay times: 2, 4, 6, 8, 12, 16 and 18 seconds. The fuze employs an arming vane to effect arming. The arming time is independent of release airspeed and is accomplished by the arming vane, a mechanical governor, and a constant-speed rotating gear train. Impact functioning (detonation) delay times are provided by inserting a delay element (M9) in the cavity just beyond the firing pin. The delay elements are available in the following delay increments for both M904 fuzes: instantaneous, 0.01, 0.025, 0.05, 0.10 and 0.25 second.

The fuze has one preflight warning window located in the fuze body. The other window, above the booster, is not visible to the aircrew.

WARNING

If the window in the fuze body shows fully red, the fuze is unsafe and should not be touched. Call explosive ordnance disposal (EOD) personnel immediately. See figure 1-107.

Fuze arming begins when the bomb is released from the aircraft. The arming wire is withdrawn from the vane and the vane spins in the airstream (operating range is 150 to 600 knots). After the selected arming time has expired, the fuze arms.

CAUTION

The M904E1 fuze has a manufacturing arming time tolerance of ± 20 percent; the M904E2 tolerance is ± 10 percent. The negative tolerance of the fuze must be used when determining the minimum arming separation between weapon and aircraft. The positive tolerance must be used to determine the minimum release altitude to insure arming before impact.

AN-M147A1 MECHANICAL TIME FUZE

The AN-M147A1 mechanical time fuze (figure 1-107A) is a combination vane and pin arming fuze. This fuze is used to detonate (or open) the M129E1, E2 leaflet bomb at a preselected time after the bomb is released from the bomb rack. When the arming wire is extracted from the arming vane and through a hole in the arming pin, the arming vane is permitted to be rotated by the airstream and the arming pin is forced out of the fuze by a spring. The arming pin was seated in a notch or a circular timing disk to prevent the alarm clock-type mechanism from operating. When the arming pin is ejected, the clockwork turns the disk at a uniform rate until the timing disk lever drops into the notch and releases the firing lever and firing pin. The time is set by rotating the head of the fuze to locate the timing disk lever at such a distance from the arming pin as will give the time desired. A thumbscrew is provided to lock the head in position after the setting is made. The time settings are engraved around the base of the head. Upon completion of the preset time interval, a small detonator charge is moved into position under the firing pin. The firing pin is propelled by a spring in the detonator. The detonator in turn detonates the booster lead which detonates the explosive cord to separate the two halves of the bomb body.

AN-M147A1 FUZE

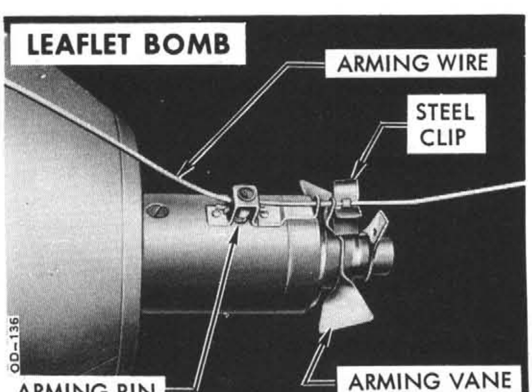

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Figure 1-107A

M907 MECHANICAL TIME FUZE

The M907 (figure 1-108) is a mechanical time nose or tail fuze commonly used for airburst functioning of bomb clusters and leaflets bombs. The desired function time is set on a calibrated dial on the fuze body. The dial may be set at 1/2 second intervals between 4 and 92 seconds. There is an airburst functioning accuracy of plus or minus 1 second. The fuze employs a four-bladed arming vane to effect arming. The arming time is independent of release airspeed and is accomplished by the arming vane, a mechanical governor and a constant speed rotating gear train. Arming time is automatically determined as one-half the preset time on the calibrated dial when the function time is greater than 10 seconds. For function times of 4 to 10 seconds, arming will occur before functioning but not less than one-half the set time. Delivery airspeeds encompass the range of 100 to 600 knots TAS. Safety features include a slider detonator block containing the detonator, which is locked out of line with the rest of the explosive train until arming is completed, and two arming (warning) indicators. One arming indicator is an aluminum foil disc located in the lower part of the fuze body. If the pin is extended through the window, the fuze is armed.

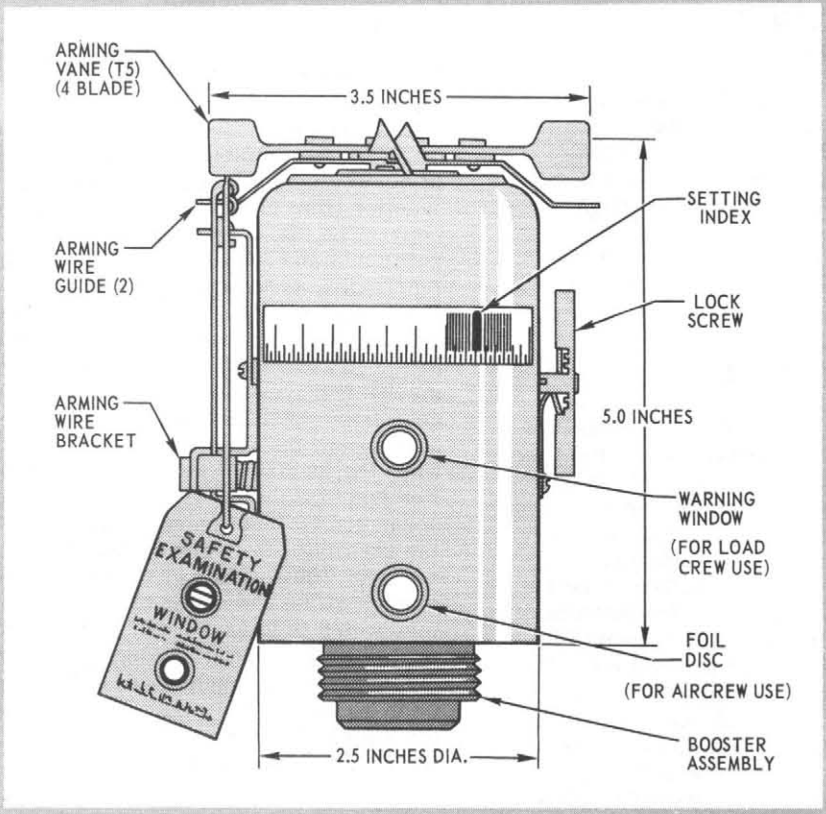
WARNING

An armed fuze can be determined by checking the aluminum arming indicator. If the slider has punctured the aluminum foil disc, the fuze is armed. Do not touch the fuze and call explosive ordnance disposal (EOD) personnel immediately.

Arming of the fuze starts when the bomb is released from the aircraft and the arming wire is withdrawn from the fuze. This permits an arming pin to be ejected and a movement assembly to begin operation. Rotational energy for air arming is provided by the arming vane which drives a constant-speed centrifugal governor. At the end of the arming cycle, a spring-loaded slider is allowed to move and bring the primer into line with the firing pin and booster. A spring-loaded detent retains the slider in the ARM position. The fuze is now armed.

Operation of the fuze starts upon release of the weapon as the arming pin is ejected. This action removes a projection from the slot in the disc assembly allowing the clockwork movement to start. Starting is assured by a spring-loaded starter which

M907 MECHANICAL TIME FUZE



M907 BOOSTER ASSEMBLY

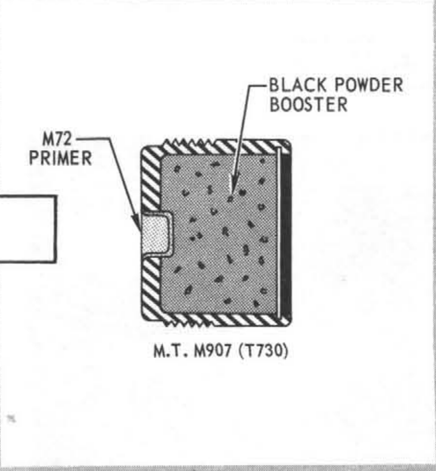


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Figure 1-108

sweeps across the escape wheel, imparting motion to it. A timing disc lever rides the periphery of the disc assembly until the slot in the disc from which the arming pin was ejected indexes with the lever. The spring-loaded lever drops into the slot, releasing the system of levers which in turn releases a spring-loaded firing pin spring retainer. This retainer then drives the firing pin into the primer, firing the fuze. If impact occurs before the set time has expired, the firing pin is driven in, shearing the trigger mechanism and firing the primer.

FMU-26B/B FUZE

The FMU-26B/B fuze (figure 1-111) is an electric fuze powered by an internal thermal battery. The fuze can be used as a nose or tail fuze and will provide an airburst or impact initiated burst. The airburst mode is intended for use only with dispenser type munitions. The fuze is cylindrically shaped, approximately 3 inches in diameter and 6.5 inches in length, and is compatible with bombs that have internal plumbing (required to route the arming lanyard) and the standard 3-inch fuze wells (nose and tail).

The arming lanyard is routed from the charging well of the bomb through the internal plumbing of the bomb to a battery firing device which is attached to the fuze in the nose or tail fuze well. The arming wire routing can be conducted in one of two ways. In one method, the free end of the arming lanyard, which is protruding from the charging well, is routed through a swivel loop and then into a lanyard lock which is installed in the charging well and secured by a lanyard lock nut. When the bomb is loaded on the bomb rack, the swivel loop is installed in the bomb rack arming solenoid. In the second method, the free end of the arming lanyard, is routed through a firing lanyard adjuster. The excess lanyard is then cut off. When the bomb is loaded on the bomb rack, the pull ring of the lanyard adjuster is installed in the bomb rack arming solenoid.

When a bomb is released armed, the arming solenoid holds the swivel loop which remains with the bomb rack as the arming lanyard is withdrawn through the swivel loop. The arming lanyard remains attached to the bomb by the lanyard lock. This action cocks and releases the firing pin which initiates the thermal battery in the fuze.

When a bomb is released armed, the arming solenoid holds the pull ring, thus pulling the lanyard. This cocks and releases the firing pin which initiates the thermal battery in the fuze. Then a shear pin breaks, separating the lanyard adjuster from its pull ring. The pull ring remains with the solenoid; the lanyard remains attached to the fuze battery firing device.

The activated thermal battery provides the electrical power for fuze operation. The fuze timing circuitry provides an arming signal at the pre-set arming time. This arming signal is used to arm the fuze; that is, to rotate the detonator from the out-of-line position to the in-line or firing position. The fuze timing circuitry then provides the firing (final event) signal at the pre-set time for impact or airburst function. The fuze modes with available arming times and final event times are tabulated below as follows:

Note

- The arming time tolerance for the short delay mode is ± 0.300 seconds. With this mode, the minimum allowable bomb time of flight (to prevent duds) will be the arming delay setting plus 0.300 seconds.
- The fuze contains a safing device which duds the fuze if impact occurs prior to arming.

MODE	ARMING TIME	FINAL EVENT TIME	EVENT TOLERANCE
Airburst 1	Selectable 1.9 to 99.9 sec in 0.5 sec increments	Selectable Occurs 0.1 sec after arming	± 0.3 sec
Impact 2 Short Delay	Selectable 2.0 to 20.0 sec in 2.0 sec increments	Selectable Non-delay, 0.010 0.020, 0.050, 0.100, or 0.250 sec	± 10% or ± 0.002 sec, whichever is greater

The event and arm times are set into the fuze with an allen wrench and are displayed in the windows on the face of the fuze. The safe pin locks the fuze rotor in the out-of-line position until after the fuze is installed in the bomb. Prior to departure of the loaded aircraft from the loading area, the safe pin is removed from the fuze and replaced with the seal pin. The seal pin prevents entry of moisture into the fuze.

The aft end of the fuze (the booster end) has a pie-shaped section to accept a booster. Two kinds of boosters are used: a 45-gram RDX booster which is secured to the fuze by tape, and a 5-gram M-5 propellant booster (FZU-1/B booster) which is secured to the fuze by a metal bracket. The bracket is also used to activate the airburst mode. The aft end of the fuze also has a safe plug and a safety switch. The safe plug is in the fuze only during shipping and handling, and is removed prior to installation of the fuze into the bomb. The battery firing device is installed in the cavity vacated by the safe plug.

When the fuze is used with dispensers, the FZU-1/B (airburst) booster is used. The lanyard lock, and the 45-gram RDX booster are not used in dispensers. When the fuze is used in high explosive bombs, the 45-gram RDX booster (booster and tape assembly) is used.

The fuze safety switch has three positions: RED, GREEN (normal), and BLUE (airburst). The GREEN (normal) position keeps the firing circuit to the detonator disabled for approximately 6.6 seconds after bomb release. The safety switch should be kept in the GREEN position for all medium delay (skip mode) settings. It should also be kept in the GREEN position for all short delay (dive mode) settings, except when operational delivery conditions are such that the time from bomb release to impact will be less than 6.6 seconds. For releases where this time is less than 6.6 seconds, the safety switch must be set in the RED position to assure fuze function at the pre-set time. The BLUE position can be selected only when the FZU-1/B (airburst) booster is installed. The FZU-1/B booster has a metal bracket which holds the spring-loaded safety switch in the BLUE position. When the FZU-1/B booster and bracket are removed, the safety switch will spring to the GREEN position. The airburst mode is inoperative when the safety switch is not in the BLUE position. If the fuze selector switch is set in the airburst mode, but the safety switch is not set in the BLUE position, the fuze will not detonate airburst, but will detonate at impact through the airburst back up circuit.

CAUTION

Whether the fuze is set in the RED or GREEN position, the minimum release altitude, or vertical drop required for safe escape, must be carefully observed as specified in the appropriate minimum release altitude/fuze arming time tables.

The fuze can be used more advantageously in the nose fuze well. Nose installation permits easier access for inspection by the aircrew and for changes of arming and event time settings if such changes are required after initial loading. The inspection and changes can be done if the nose plug is removed. If the tail fuze well is used, the initial fuze settings are most easily accomplished before the fuze is installed in the bomb. After fuze installation, settings are most easily accomplished with the bomb tail fin removed. Changes in tail fuze settings require removal of the fuze from the bomb, or removal of the tail fin and fuze nose plug.

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FMU-26A/B FUZE

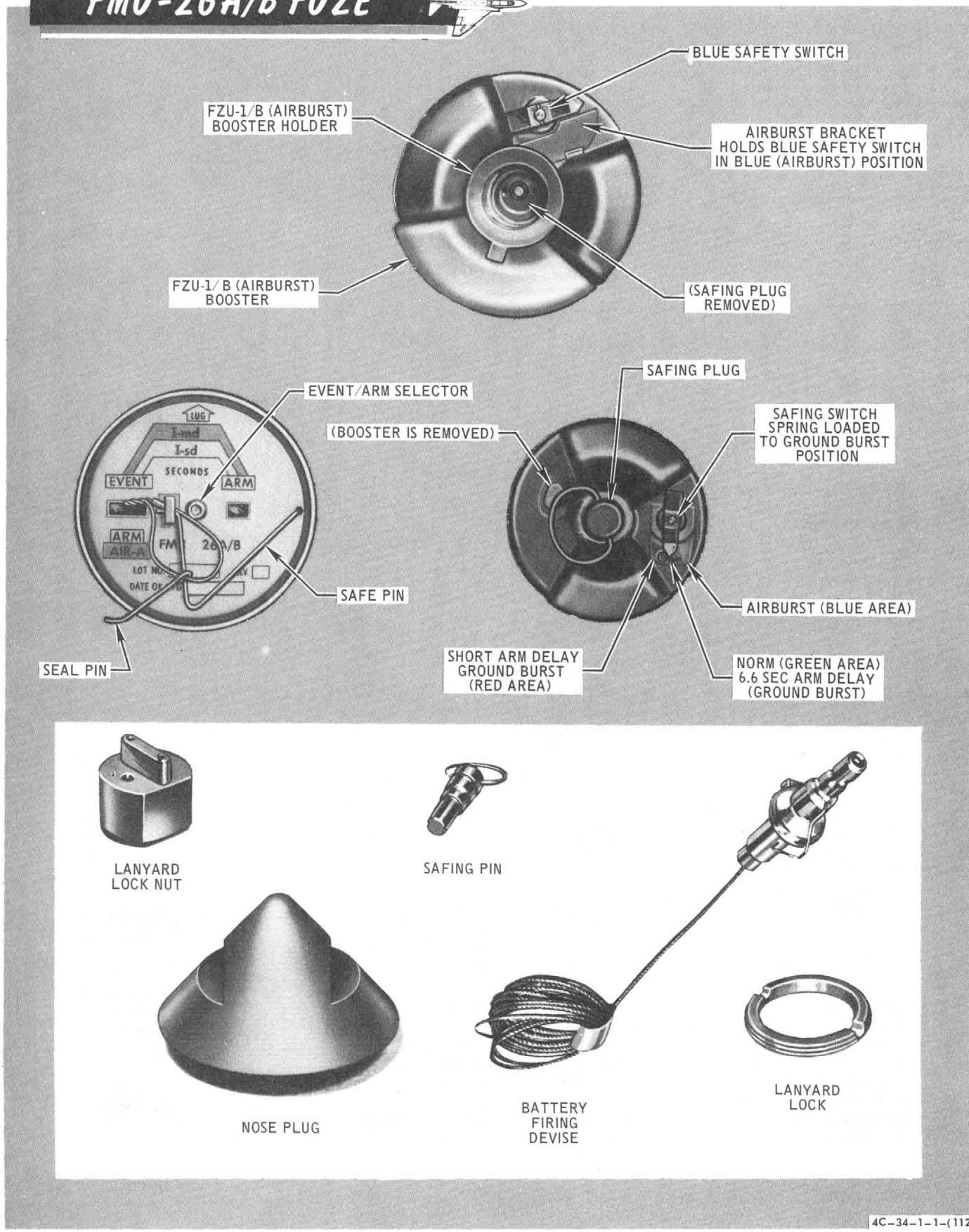

Figure 1-110

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FMU-26B/B FUZE

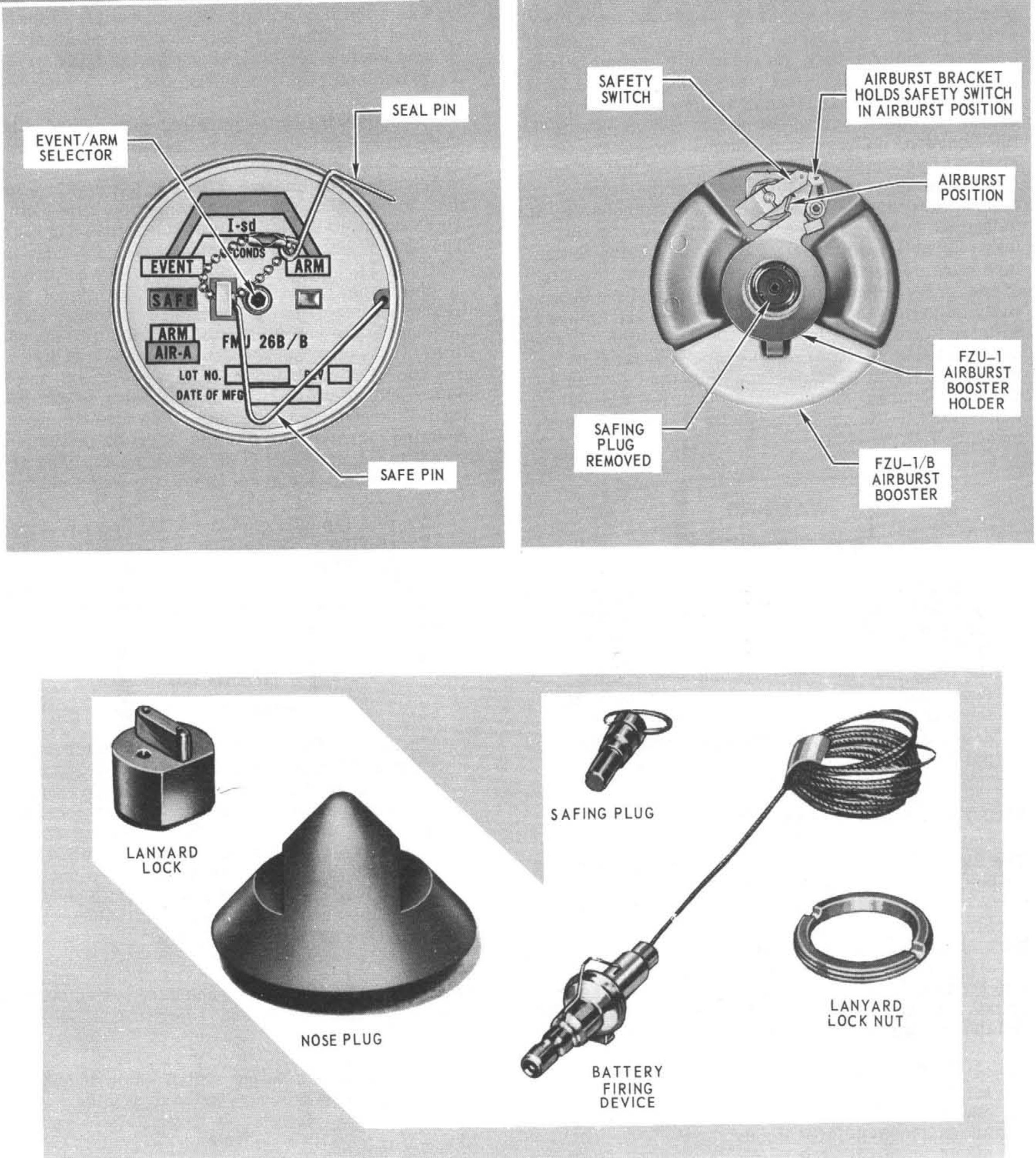

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Figure 1-111

FMU-30/B NOSE FUZE

The FMU-30/B fuze and power supply (figure 1-112) is a pressure-sensitive fuze. It is intended primarily for use in the standard 3-inch diameter fuze well of the BLU-31/B land mine. The fuze contains a battery power supply, an electronic assembly composed of electromagnetic timers and sequential logic circuitry, an electromechanical arm/safe mechanism, a rotor-mounted detonator with an out-of-line position, and a pressure detection system consisting of an amplifier and three piezo-electric sensors mounted under sensor covers in the sides of the nose forging. An externally mounted booster, attached as shown in figure 1-112, is used with the fuze to enable it to initiate the high explosive in the land mine. Figure 1-112 also indicates the location of the target selector adjustment plug and the sensitivity adjustment. All FMU-30/B fuzes are shipped with the target selector in the No. 1 position. If any other position is required, the pipe plug must be removed and the desired position selected. For additional information on the operation of the FMU-30/B fuze, refer to the secret supplement to this delivery manual, T.O. 1F-4C-34-1-1B.

WARNING

If the color visible through the arm/safe indicator window on the side of the nose forging (see figure 1-112) is GREEN, the FMU-30/B fuze is safe. If the RED color is visible the rotor may have become unlocked and the fuze must be considered armed. In this event the fuze must not be used. Do not touch fuze and notify explosive ordnance disposal (EOD) personnel immediately.

FMU-72/B LONG DELAY FUZE

The FMU-72/B long delay bomb fuze is cylindrically shaped, approximately 3 inches in diameter, and 6 1/2 inches long. The fuze and components (figure 1-113) are used with compatible munitions to assemble a completely fuzed munition.

The FMU-72/B fuze is compatible with the nose and/ or tail fuze wells of all bombs with internal plumbing and the standard 3-inch fuze well, which include the:

a. M117, 750-lb., GP Bomb
b. M118, 3000-lb., GP Bomb
c. Mk 82, 500-lb., GP Bomb
d. Mk 83, 1000-lb., GP Bomb
e. Mk 84, 1500-lb., GP Bomb

The FMU-72/B can be used either in the nose or tail fuze well. Settings must be made prior to installing the fuze in the fuze well. If a change in a setting is required after installing the fuze, it must be removed from the bomb to make the change.

CAUTION

Since the fuze settings are not visible to the pilot for inspection, the munitions handling and loading personnel must be carefully briefed on required settings.

The FMU-72/B fuze is activated upon armed release. The swivel and link assembly is held by the arming solenoid and stays with the aircraft; when the bomb is released, the lanyard is pulled. This pull (greater than 36 pounds) cocks and releases the firing pin which initiates the liquid ammonia battery in the fuze. The battery provides electrical power for fuze operation. The arming circuitry provides a fixed delay for the signal for arming. The arming signal is used to arm the fuze, that is, rotate the detonator from the out-of-line position to the in-line or firing position. To assure that the detonator does not fire at arming, it is grounded until impact occurs, and the power source which fires the detonator is not charged until 33 seconds after impact. The fuze timing and counting circuitry provide the firing or final event signal at the set event time after impact. The arming time and selectable event times are listed below:

a. Arming Time: Fixed at 6.0 (+1.5, -1.0) seconds
b. Event Times: Selectable in 20-minute increments from 20 minutes to 5 hours; 1-hour increments from 5 hours to 16 hours; 2-hour increments from 16 hours to 30 hours; and 3-hour increments from 30 hours to 36 hours.

WARNING

When the FMU-72/B fuze is used in general purpose bombs, select minimum release altitudes which will provide safe escape from bomb fragments for instantaneous or contact bursts. This is required to protect the aircraft and aircrew in the event of a premature bomb detonation at initial impact. To preclude ricochet, release conditions for general purpose bombs should provide a trajectory angle at impact in excess of 40°.

For detailed information concerning anti-disturbance feature and impact spacing, refer to T.O. 1F-4C-34-1-1A.

The fuze contains a safing switch which duds the fuze in the event impact occurs prior to arming.

Note

To assure adequate time for the FMU-72/B fuze to arm prior to impact, use the minimum release altitudes as specified in the fuze arming time tables for the M904E2/ M905 fuze with a 6 second arming delay setting, section VI.

FMU-72/B LONG DELAY FUZE

The FMU-72/B long delay bomb fuze is cylindrically shaped, approximately 3 inches in diameter, and 6 1/2 inches long. The fuze and components (figure 1-113) are used with compatible munitions to assemble a completely fuzed munition.

The FMU-72/B fuze is compatible with the nose and/or tail fuze wells of all bombs with internal plumbing and the standard 3-inch fuze well, which include the:

a. M117, 750-lb., GP Bomb
b. M118, 3000-lb., GP Bomb
c. Mk 82, 500-lb., GP Bomb
d. Mk 83, 1000-lb., GP Bomb
e. Mk 84, 2000-lb., GP Bomb

The FMU-72/B can be used either in the nose or tail fuze well. Settings must be made prior to installing the fuze in the fuze well. If a change in a setting is required after installing the fuze, it must be removed from the bomb to make the change.

CAUTION

Since the fuze settings are not visible to the pilot for inspection, the munitions handling and loading personnel must be carefully briefed on required settings.

The FMU-72/B fuze is activated upon armed release. The swivel and link assembly is held by the arming solenoid and stays with the aircraft; when the bomb is released, the lanyard is pulled. This pull (greater than 36 pounds) cocks and releases the firing pin which initiates the liquid ammonia battery in the fuze. The battery provides electrical power for fuze operation. The arming circuitry provides a fixed delay for the signal for arming. The arming signal is used to arm the fuze, that is, rotate the detonator from the out-of-line position to the in-line or firing position. To assure that the detonator does not fire at arming, it is grounded until impact occurs, and the power source which fires the detonator is not charged until 33 seconds after impact. The fuze timing and counting circuitry provide the firing or final event signal at the set event time after impact. The arming time and selectable event times are listed below:

a. Arming Time: Fixed at 6.0 (+1.5, -1.0) seconds
b. Event Times: Selectable in 20-minute increments from 20 minutes to 5 hours; 1-hour increments from 5 hours to 16 hours; 2-hour increments from 16 hours to 30 hours; and 3-hour increments from 30 hours to 36 hours.

WARNING

When the FMU-72/B fuze is used in general purpose bombs, select minimum release altitudes which will provide safe escape from bomb fragments for instantaneous or contact bursts. This is required to protect the aircraft and aircrew in the event of a premature bomb detonation at initial impact. To preclude ricochet, release conditions for general purpose bombs should provide a trajectory angle at impact in excess of 40°.

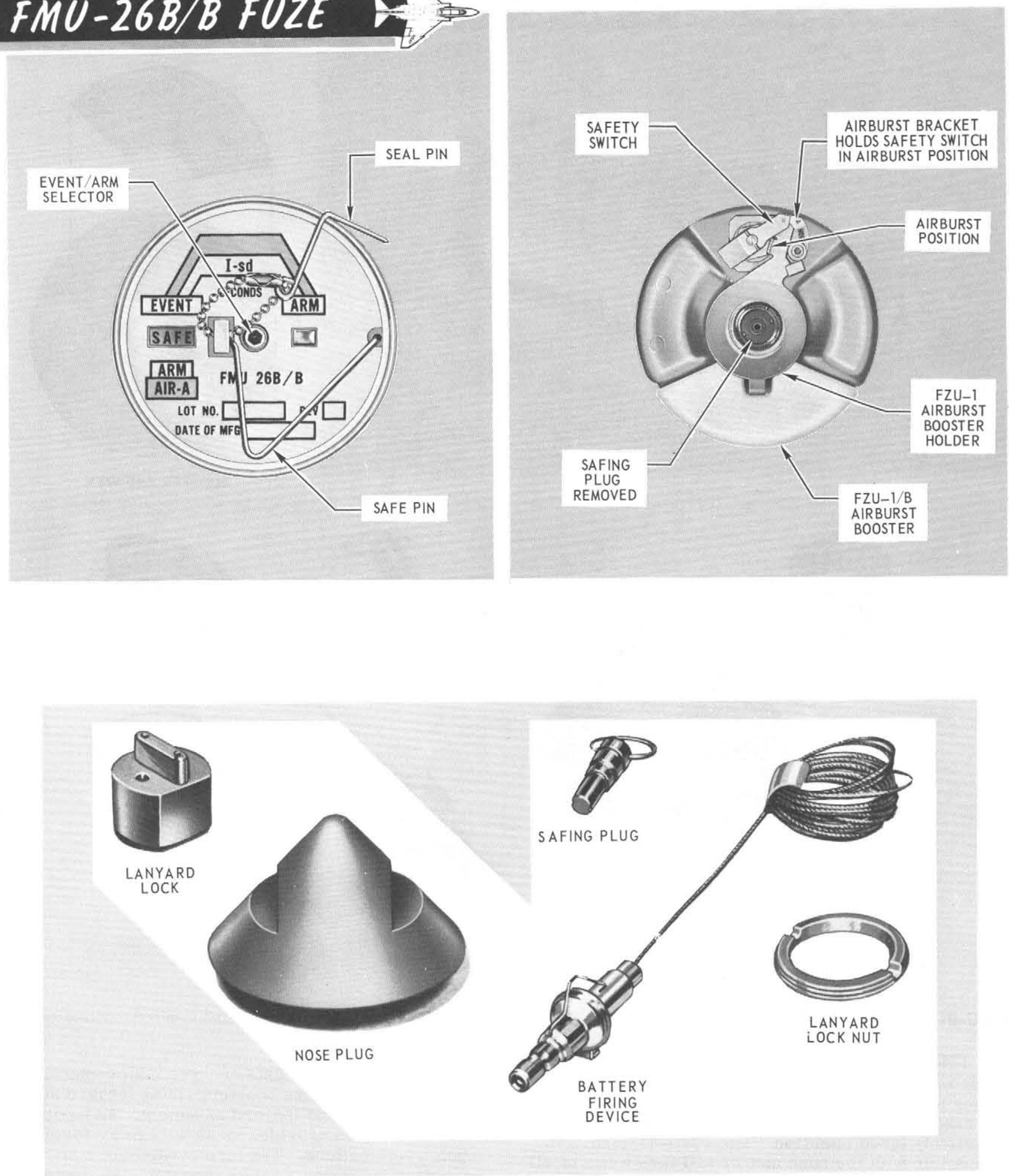
For detailed information concerning anti-disturbance feature and impact spacing, refer to T.O. 1F-4C-34-1-1-1.

The fuze contains a safing switch which duds the fuze in the event impact occurs prior to arming.

Note

To assure adequate time for the FMU-72/B fuze to arm prior to impact, use the minimum release altitudes as specified in the fuze arming time tables for the M904E2/M905 fuze with a 6 second arming delay setting, section VI.

FMU-26B/B FUZE



4C-34-1-1-(113)

Figure 1-111

FMU-72/B LONG DELAY FUZE

Figure 1-113

FMU-81/B SHORT DELAY FUZE

The FMU-81/B short delay bomb fuze is cylindrically shaped, approximately 3 inches in diameter, and 11 inches long. The fuze and components (figure 1-113A) are used with compatible munitions to assemble a completely fuzed munition. The FMU-81/B fuze is compatible with the nose and/or tail fuze wells of all low drag bombs with internal plumbing and the standard 3-inch fuze well, which include the:

a. M117, 750-lb, GP Bomb
b. M118, 3000-lb, GP Bomb
c. Mk-82, 500-lb, GP Bomb
d. Mk-83, 1000-lb, GP Bomb
e. Mk-84, 2000-lb, GP Bomb
f. BLU-31/B, 750-lb, Demolition Bomb

The FMU-81/B fuze is also intended for use with guided bombs.

The FMU-81/B consists of three major assemblies: fuze, FZU-2/B fuze booster, firing lanyard adjuster (MAU-162/A) and lanyard assembly. An auxiliary booster clip is provided as an accessory for guided-bomb applications. The fuze consists of a body, nose, safety clip, thrust washer, booster clip, battery firing device (BFD), lanyard assembly, hitch pin with warning tag, and safe pin. The body is a steel cylinder with a window near the end opposite the nose. Contained within the body are a battery, a safing and arming mechanism (S&A), and an electronics assembly. The nose is a cone-shaped casting 4.2 inches in diameter, integral with the fuze body. It contains two thumbwheel setting knobs, one for arming delay

and one for impact delay, held in place by a fuze nose plug and connected to selector switches in the electronics assembly by two mating shafts. A seal plug and safety clip with warning tag complete the unit. The thrust washer is a spacer surrounding the fuze body at the base of the nose and has an outer diameter of 4.35 inches. The thrust washer is used only when the fuze is installed in the nose fuze well. The booster clip is a spring-steel holder that fits into the booster recess at the end of the fuze body. The BFD is a steel cylinder integral with the fuze body that protrudes from the recessed end of the body. It contains a firing pin held in restraint by a shear wire until initiated by a pull from the lanyard. The lanyard assembly is a braided steel cable connected to the BFD by a ball and shank. The hitch pin is a safety pin inserted in a hole in the BFD housing and lanyard rod. This pin is removed before fuzing the bomb. The safe pin is a slender steel rod that is visible through the window in the fuze body and extends through the body and nose to the seal plug.

The fuze booster is shaped to fit the contour of the fuze booster cavity and to be snapped into position under the booster clip.

The firing lanyard adjuster (MAU-162/A) consists of a lanyard tie-off block, a pull ring, and a shear wire.

The auxiliary booster clip is a spring-steel holder that holds three supplementary boosters in place around the BFD when the fuze is used in a guided bomb.

Safety Features

A SAFE position of the arming-delay-setting thumbwheel renders the arming circuit inoperable in this position. Locking plates behind the arming-delay and impact-delay setting thumbwheels prevent accidental movement of the thumbwheels during ground handling of the fuze. A safe pin reveals a potentially armed condition of the fuze by visibly protruding through a seal plug on the fuze nose. The safe pin holds the rotor out of line until the pin is driven through the plug by the arm-enable bellows.

WARNING

If the safe pin is protruding through the seal plug in the fuze nose, the fuze shall be considered armed. In this event, the fuze shall not be used. Do not touch fuze and notify explosive ordnance disposal (EOD) personnel immediately.

A safety clip on the fuze nose prevents the safe pin from releasing the rotor until the safety clip is manually removed during installation in a bomb. If the BFD is accidentally initiated during handling, the safe pin permanently locks the safety clip in place to reveal a defective fuze condition to the munition handler. A hitch pin prevents actuation of the BFD until manually removed during bomb installation.

The S&A provides out-of-line safety until the rotor is freed by movement of the safe pin and propelled in line by an arming bellows after BFD initiation. If an impact of greater than 250 G should occur prior to arming, the safing switch and/or the detonator enable switch will function and prevent the fuze from arming. If an arming signal should be generated prior to arm-enable (removal of the safe pin), the rotor will attempt to rotate and will deform a locking tang, which then permanently locks the rotor out of line. The S&A also prevents battery voltage from reaching the event circuitry before mechanical arming occurs.

The arm-enable circuitry prevents premature actuation of the arm-enable bellows by means of a resistor-capacitor combination that limits the enable-bellows charging current until the pre-set timing circuit releases a voltage pulse and triggers the capacitor to discharge into the bellows.

FMU-81/B FUNCTIONAL DESCRIPTION

Arming Delay

Any of nine arming-delay settings (4, 5, 6, 7, 8, 10, 12, 14, or 20 seconds) or a SAFE setting can be selected by means of the thumbwheel setting knob (figure 1-113A) of the arming-delay selector switch. The tolerance on the arming delay is ± 5%. The arming-delay settings may be made before or after installation of the fuze in the bomb.

Impact Delay

Any of six impact-delay settings (.00, .01, .02, .05, .10, or .25 second) can be selected by means of the thumbwheel setting knob (figure 1-113A) of the impact-delay selector switch. The impact-delay settings may be made before or after installation of the fuze in the bomb.

The fuze can be used more advantageously in the nose fuze well. Nose installation permits inspection by the aircrew and for changes of arming and event time settings if such changes are required after initial loading. If the tail fuze well is used, the removal of the safe and arm safety clip cannot be verified by external inspection of the bomb, and the removal of the safety clip immediately prior to launch requires the removal and reinstallation of the tail fin access cover. Also when returning to base with unexpended or hung bombs, timely verification of the armed/unarmed status of the tail fuze cannot be ascertained by external inspection of the bomb.

Operational Sequence

Upon bomb release, a lanyard pull of 20 pounds or more shears a pin in the BFD and releases the BFD firing pin. The firing pin initiates a primer cap, which in turn initiates heat paper within the battery. The heat paper raises the battery temperature to generate battery voltage. After a battery rise time of 0.4 ± 0.125 second, the battery produces the 11 volts necessary to operate the timing and control circuitry in the fuze. At approximately 3/4 of the set arm time, the enable bellows motor is activated,

FMU-81/B SHORT DELAY FUZE

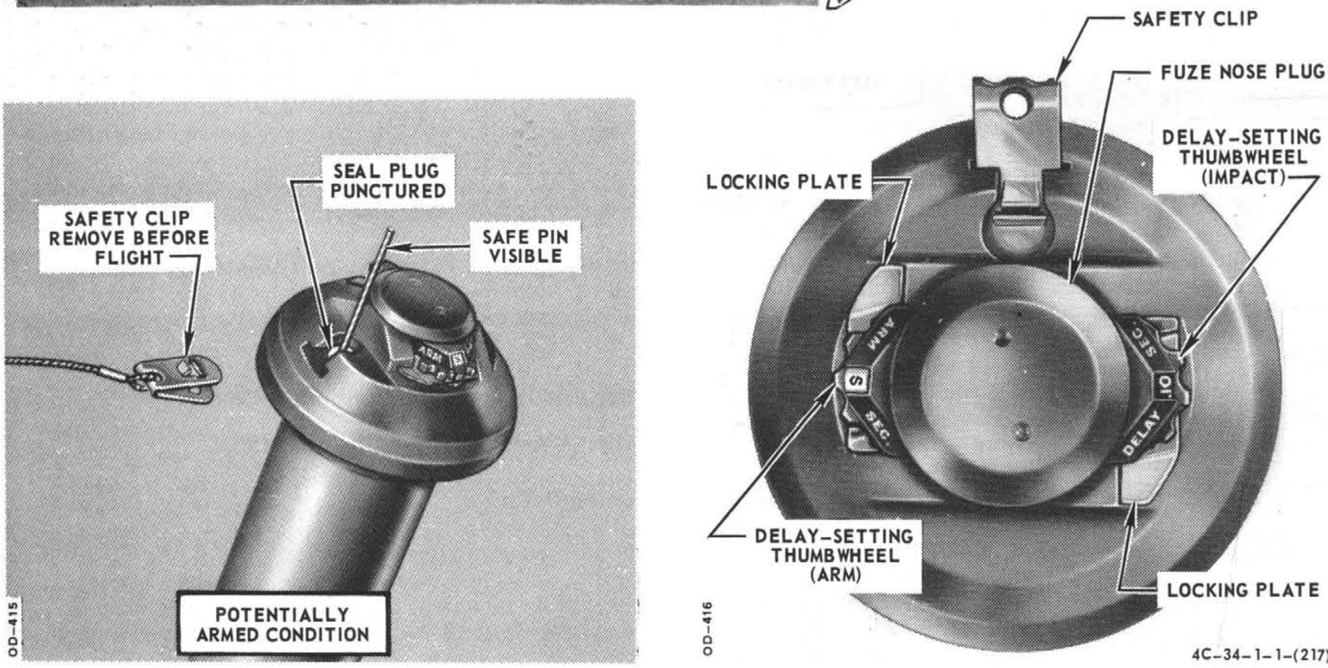


Figure 1-113A

removing the safe pin block on the S&A. At the set arm time the arming bellows motor is activated, moving the detonator to the in-line position. On impact, the fuze functions after elapse of the pre-set impact delay.

FMU-56/B PROXIMITY FUZE

The FMU-56/B (figure 1-114) is a self-powered doppler radar proximity fuze used to open a free-falling cluster bomb unit (CBU): CBU-24B/B, -29B/B, -49B/B, and -52A/B series. The fuze has provisions for presetting fuze arming time and dispenser height of burst. The fuze is constructed in two cylindrically shaped sections. The smaller section fits into the fuze well of the munition and the larger section protrudes externally.

The FMU-56/B proximity fuze is an altitude sensing fuze with 9 settings available for burst altitude and 9 safe separation settings (2 to 18 seconds). Burst settings are set on the fuze prior to installation in the munition; safe separation settings (arming time) may be made after the fuze is installed in the munition. Switch position and corresponding height of burst (HOB).

HOB SELECTOR SWITCH

Switch Position	Function (ft AGL)
0	0
1	250
2	500
3	800
4	1100
5	1500
6	1800
7	2100
8	2500
9	3000

The available switch positions and corresponding safe separation times for the arming time selector are listed in the following table.

ARMING TIME SELECTOR SWITCH

Switch Position	Arming Time (sec)
S or 0	Safe
A or 1	2
B or 2	3
C or 3	4
D or 4	6
E or 5	8
F or 6	10
G or 7	12
H or 8	14
J or 9	18

CAUTION

Use of a minimum safe separation setting of 3 seconds is recommended for all release situations to assure adequate aircraft/munition separation distance at cluster opening time.

The fuze subassembly contains the doppler ranging radar, battery, and safing and arming device. The fuze subassembly is equipped with two safety devices which are removable; a safing plug which is removed before loading and a shorting pin which is removed before flight. Construction consists of a steel cylinder to which a threaded aluminum collar and a plastic radome are attached. A retainer clip attached to a depression in the rear of the steel cylinder holds one booster fuze (FZU-1/B). The threaded collar secures the fuze assembly in the CBU fuzewell. The FZU-1/B fuze booster contains five grams of M5 propellant in a metal container topped by a foam filler. The booster is attached to the rear of the fuze assembly. Detonation of the booster causes nose cap of the CBU to separate.

The battery firing device consists of a steel initiator, a retaining clip and a lanyard of steel cable. The lanyard is routed through the CBU lanyard tube as illustrated in figure 1-106. The fuze subassembly is positioned over the initiator which allows the initiator firing pin to strike the battery primer when the lanyard is pulled.

After the CBU is released from the aircraft, the battery firing device is activated when the lanyard is pulled. The firing pin of the battery firing device initiator strikes the battery primer, igniting the battery which applies power to the fuze circuitry and starts the arming timer. The arming timer runs for its preset time, at the end of which the fuze will arm provided the velocity sensor switch is closed.

When energized, the radar circuitry of the fuze is continually checking the CBU's height above the ground and the vertical component of its velocity with respect to the ground. The height above the ground is measured by determining the time required for the radar pulse to reach the ground and return to the fuze. The closing velocity of the CBU is determined from the amount of doppler shift in the returned signal with respect to the fuze's internal reference oscillator. When the height above ground (measured by the fuze) is the same as the height of burst, and the closing velocity of the munition is greater than a predetermined minimum value, the detonator fires through the booster ignition port of the fuze housing to detonate the booster. Detonation of the booster pushes the FMU-56/B fuze and the CBU nose cap out of the CBU cannister allowing the CBU to separate into two pieces and disperse the payload.

Safety Features

Before the FMU-56/B will arm, the following sequence of events must occur:

a. The SAFING PLUG must be removed from the fuze assembly.
b. The battery must be ignited.
c. The SHORTING PIN connected as a short across the battery must be removed.
d. The ARMING TIMER SWITCH must be set to a position other than 0.
e. Air flow sensed by the VELOCITY SENSOR ports at the expiration of safe separation time must exceed 150 knots.

When safing plug is installed in the rear of the fuze subassembly, the safing plug locks the safing and arming rotor in the SAFE position. With the safing plug in place the battery cannot be ignited. If the battery is ignited while the shorting pin is installed in the proper receptacles, the battery will be shorted to ground and will discharge. When the arming timer switch is set to 0, the safe separation timer will not run and the safing and arming device will not receive an ARM signal and will remain in the SAFE position. When the velocity of air sensed at the velocity sensor ports is less than 150 knots, the switch will remain open, breaking the arm circuit to the safing and arming device.

Note

Since the fuze height-of-burst and arming time selector switch positions are set by the load crew, the munitions handling and loading personnel must be carefully briefed on the required settings.

FMU-56A/B PROXIMITY FUZE

The FMU-56A/B is an improved version of the FMU-56/B (figure 1-114). The major differences between the FMU-56/B and FMU-56A/B fuzes are in the selectable safe separation times (SST), the selectable heights of burst (HOB), and provisions in the FMU-56A/B for presetting and ECM operational mode. For additional information concerning the ECM operational mode, refer to T.O. 1F-4C-34-1-1A. The FMU-56A/B ECM switch must be set to ON or OFF as required by the mission.

FMU-56/B, A/B, B/B PROXIMITY FUZE

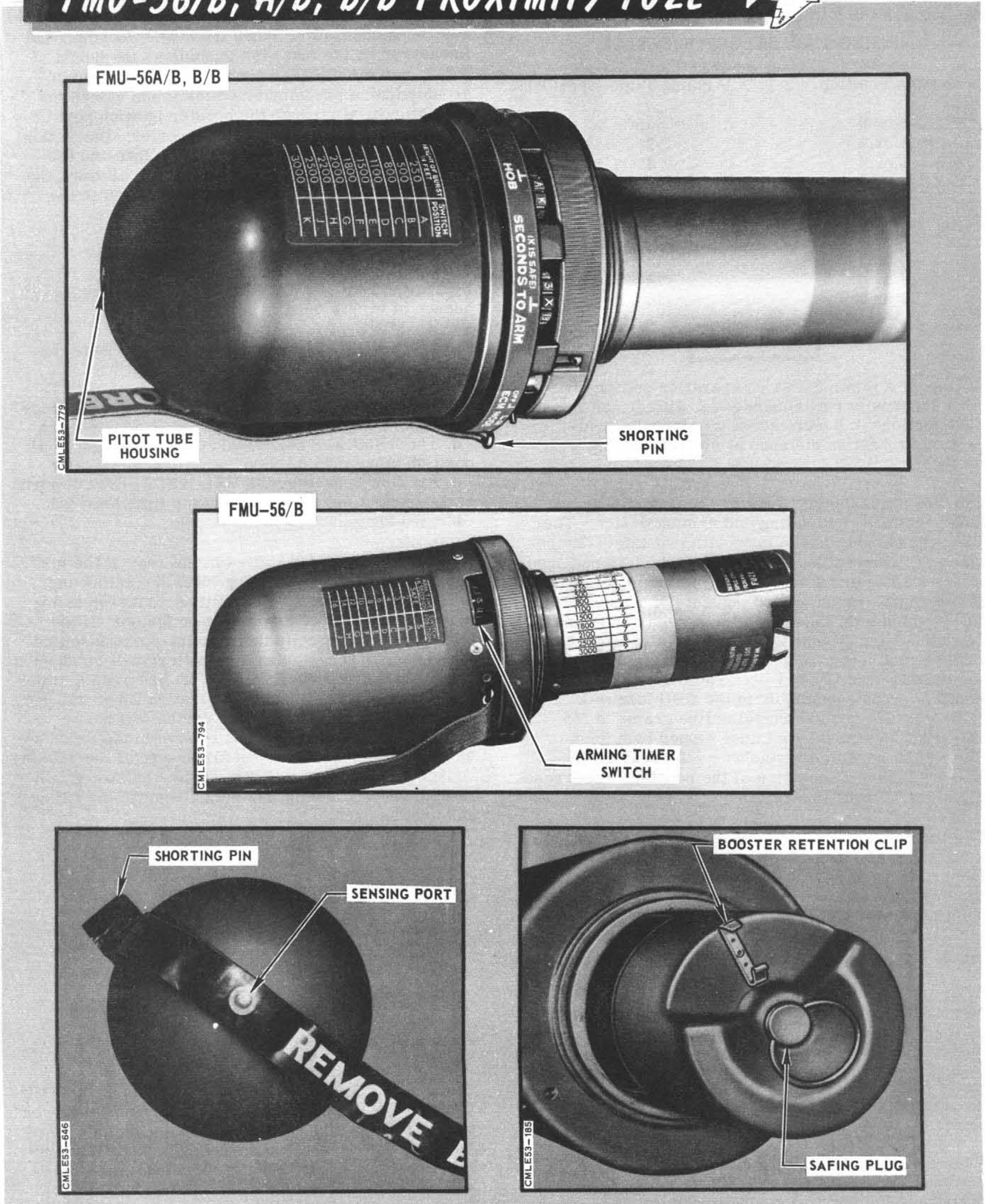


Figure 1-114

The arming time and height of burst values that are available with the FMU-56A/B fuze are as follows:

Switch Position	Arming Time-sec	Switch Position	Height of Burst-ft
X	Safe	A	250
3	3	B	500
4	4	C	800
5	5	D	1100
6	6	E	1500
7	7	F	1800
8	8	G	2000
9	9	H	2200
10	10	J	2500
18	18	K	3000

Note

The arming timer tolerance for the FMU-56/B and FMU-56A/B fuzes is ± 10% of the selected value or ± 0.5 sec, whichever is greater. During mission planning, where either FMU-56/B or FMU-56A/B fuzed munitions are involved, the munition time of flight from release to function altitude must be greater than the arming timer setting plus the tolerance. This procedure must be carefully observed. If the munition passes through the selected function height prior to the expiration of the pre-set arming time, the fuze will not function and a dud round will be the result.

In addition to the major differences described above, all FMU-56A/B selector switches have been located on the antenna support collar to provide for complete selectability after the fuze has been installed in the munition. The velocity (pitot) system has been redesigned to provide for improved sealing of the fuze radome. The two stage safe separation (SST) function in the FMU-56A/B will deploy the pop-out pitot tube through a fracture disk in the nose of the radome prior to the expiration of the selected safe separation time (SST). The pop-out pitot tube will then sample the air stream and the contacts of the velocity switch will close if the velocity sensor detects an air flow greater than 150 knots. This switch closure allows the output of the SST to proceed to the bellows actuator in the safety and arming device. The function of the safing plug, safing pin, and the safe position of the SST selector switch are unchanged.

Safety Features

The following additional safety features are available with the FMU-56A/B:

a. Impact switch. Should the fuze impact the ground prior to the expiration of the preset safe arming time, the impact switch will prevent the fuze from arming.

b. Visual arm indicator. When the velocity sensor system is activated, a pitot tube will be extended from the radome. The extended pitot tube is an indication that the battery has been ignited and the fuze should be treated as armed.

FMU-56B/B PROXIMITY FUZE

The FMU-56B/B proximity fuze is identical to the FMU-56A/B except the FMU-56B/B has an integral battery firing device and lanyard and a safing pin in lieu of a shorting pin. The lanyard, battery firing device and fuze must be installed in or removed from the dispenser as a unit.

Note

For ripple releases of FMU-56 fuzed munitions, if different heights of burst are to be used the first munition in the ripple release should be set to the lowest height of burst.

TAIL FUZES

M905 TAIL FUZE

The M905 (figure 1-115) is a mechanical impact tail fuze commonly used with general purpose bombs. It is approximately 6-1/8 inches long and 2 inches in diameter at the fuze threads. Arming is effected by the ATU-35/B or -35A/B arming drive assembly through a flexible shaft instead of by an arming vane (figure 1-115). The arming time is independent of release airspeed; this is accomplished by the arming drive assembly, flexible shaft, mechanical governor, and constant-speed rotating gear train. The desired arming time is set on a calibrated dial with selective delay time of 4, 6, 8, 12, 16, and 20 seconds. Impact functioning (detonation) delay times are provided by inserting a delay element (M9) in the cavity just beyond the firing pin. The delay elements are available in the following delay increments: Instantaneous, 0.01, 0.025, 0.05, 0.10 and 0.25 second. The fuze has one warning window visible for aircrew preflight located in the fuze body. If the fuze should become armed, the warning window will show fully red. The other window, above the booster, is not visible to the aircrew.

WARNING

If the window in the fuze body shows fully red, the fuze is unsafe and should not be touched. Call explosive ordnance disposal personnel (EOD) immediately.

Fuze arming starts when the bomb is released from the aircraft and the arming wire is withdrawn from the vane tab of the arming drive assembly. This permits the vane tab to rotate the inner parts of the fuze (operating range of the fuze is 150 - 600 knots). After the selected arming time has expired, the firing pin is free to move in the direction of flight upon sufficient deceleration of the fuze. An anti-creep spring prevents premature movement of the firing pin due to velocity changes of the bomb during free fall. At the expiration of the arming time the fuze arms. A detent locks the rotor in the armed position, and the fuze is then armed.

TAIL FUZES

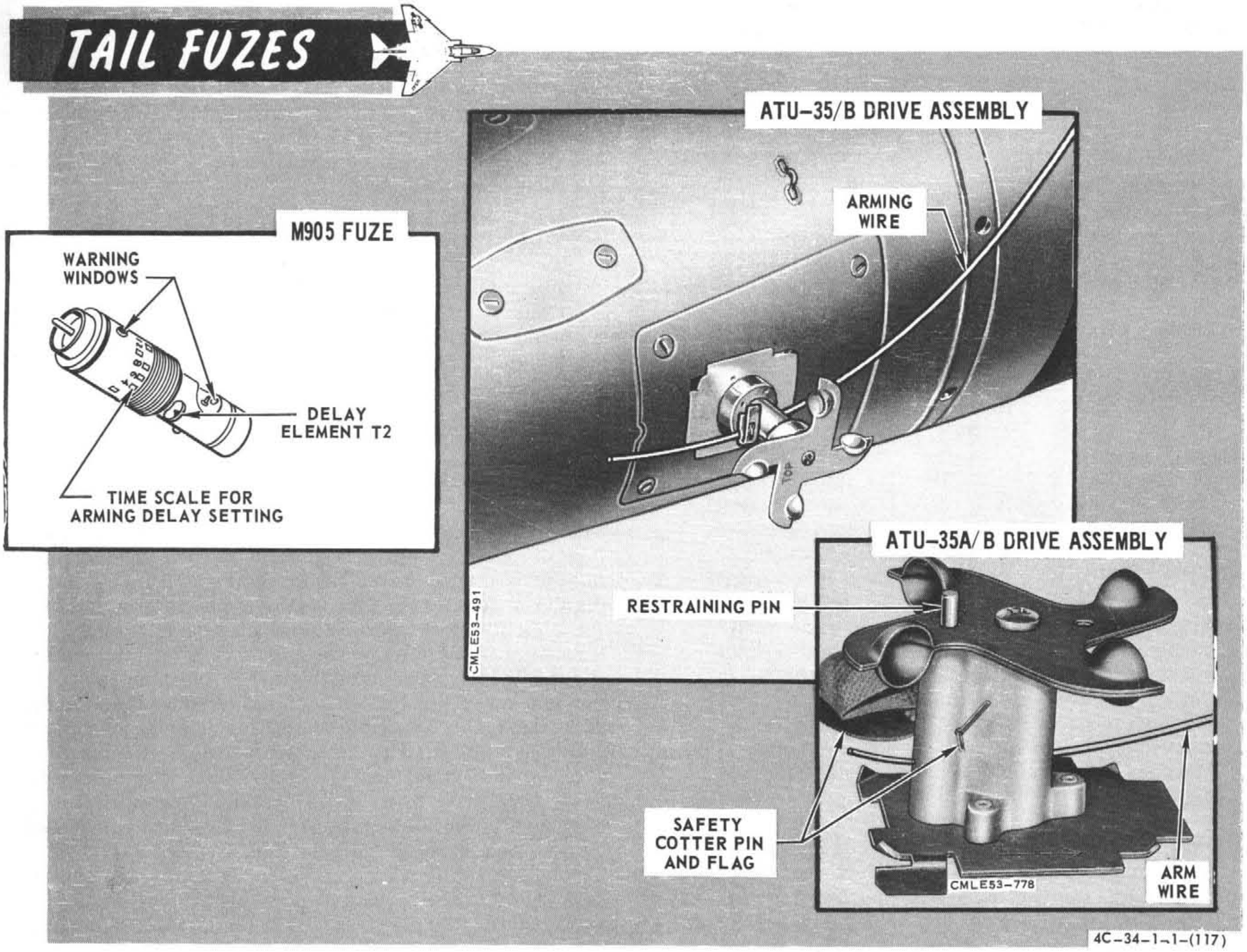


Figure 1-115

CAUTION

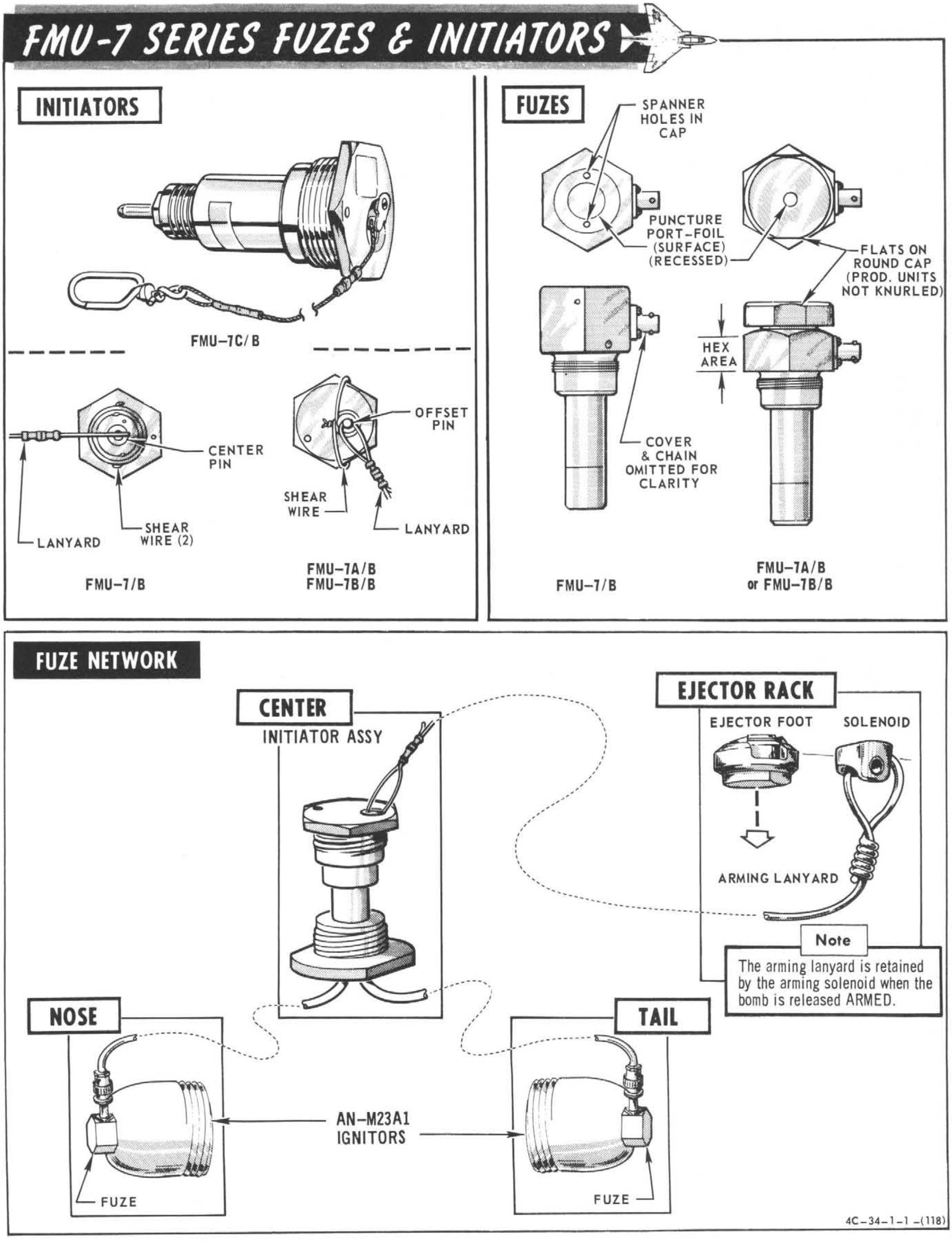
The M905 fuze has a manufacturing arming time tolerance of ± 20 percent. The negative tolerance of the fuze must be used when determining the minimum arming separation between weapon and aircraft. The positive tolerance must be used to determine the minimum release altitude to insure arming before impact.

When the bomb impacts on target, the inertia generated by the bomb causes the firing pin assembly to move forward and strikes the primer in the delay elements, thus initiating the explosive train.

FMU-7 Series Fuzes and Initiators

The fire bombs employ the FMU-7 Series fuzes (figure 1-116) and the M23 or AN-M23A1 igniters (figure 1-117) for nose and tail fuzing. The fuze is electrically armed by an initiator assembly installed between the bomb suspension lugs. An arming lanyard is connected from the initiator assembly to the bomb rack solenoid. The initiator assembly consists of a spring-loaded firing pin, a 1.5 volt thermal battery, and electric cabling that connects the initiator to the fuzes through internal channels in the fire bomb.

The fuze functions by mechanical impact at any angle of impact and can be used as either a nose or a tail fuze. In the fire bomb, the fuze is enclosed in an M23 or AN-M23A1 igniter, and forms part of the fuzing network consisting of an arming lanyard and initiator (figure 1-116) and electric cabling. The fuze is 2 inches in diameter at the fuze threads and 4.2 inches long. Arming is accomplished by the initiator through a spring-loaded firing pin and thermal battery assembly. The fuze functions instantaneously upon impact, and has no provisions for delayed functioning. Safety features are of the arming-stem safe principle. The FMU-7/B fuze includes a red-tipped indicator pin permitting visual inspection. The FMU-7A/B, B/B, C/B includes a seal permitting visual inspection.



FMU-7 SERIES FUZES & INITIATORS
INITIATORS
FMU-7C/B
CENTER PIN
SHEAR WIRE (2)
LANYARD
FMU-7/B
OFFSET PIN
SHEAR WIRE
LANYARD
FMU-7A/B
FMU-7B/B
FUZES
SPANNER HOLES IN CAP
PUNCTURE PORT-FOIL
(SURFACE)
(RECESSED)
FLATS ON ROUND CAP (PROD. UNITS NOT KNURLED)
HEX AREA
COVER & CHAIN OMITTED FOR CLARITY
FMU-7/B
FMU-7A/B
or FMU-7B/B
FUZE NETWORK
CENTER
INITIATOR ASSY
EJECTOR RACK
EJECTOR FOOT
SOLENOID
ARMING LANYARD
Note
The arming lanyard is retained by the arming solenoid when the bomb is released ARMED.
NOSE
TAIL
AN-M23A1
IGNITORS
FUZE
FUZE
4C-34-1-1-(118)

Figure 1-116

The initiator assembly (figure 1-116) is located on the top of the fire bomb between the suspension lugs. It consists of an arming lanyard, spring-loaded firing pin and 1.5-volt thermal battery. Electric cabling connects the initiator to the fuzes through internal channels in the fire bomb.

Arming is initiated as the weapon is ejected from the aircraft pylon. The arming lanyard (retained by the pylon arming solenoid) pulls the initiator cap from the initiator. As a result, a spring-loaded firing pin is released, forcing it against the primer, and activating the thermal battery. The output of the thermal battery rises to a 1.5 volts pulse. The pulse is passed through the electrical cabling in the fire bomb to a bellows motor in the fuze. The bellows motor withdraws the arming pin which in turn frees the firing pin. The fuze is now armed. The time from firing of the thermal battery to completion of fuze arming is 0.5 to 1.1 seconds for the FMU-7/B fuze and 0.3 to 0.9 second for the FMU-7A/B, B/B, C/B fuzes. The FMU-7/B fuze when armed, will have a pin protruding from the center of the fuze head. The FMU-7A/B, B/B, C/B fuze when armed, will have a seal broken in the center of the fuze head. Once armed, the fuze cannot be reset.

WARNING

If pin protrudes through hole in center of FMU-7/B fuze head or if seal is broken in center of FMU-7A/B, B/B, C/B fuze head, fuze is armed. Do not touch the fuze and notify explosive ordnance disposal (EOD) personnel immediately.

Upon impact, the fuze firing pin and firing pin holder are forced together, firing the primer. Functioning of the fuze causes ignition of the M23 or AN-M23A1 phosphorus igniter which, in turn, ignites the napalm mixture.

M23 OR AN-M23A1 IGNITER

The M23 or AN-M23A1 igniters (figure 1-117) are cylindrical in shape and rounded at one end. In the rounded end is a fuze well,designed to receive the FMU-7/B, A/B, B/B, C/B bomb fuze. The body of the igniter is filled with 1.25 pounds of white phosphorus (WP).

When the fuze impacts a target, the fuze functions and the booster in the fuze detonates, bursting the igniter and scattering the white phosphorus filling. The phosphorus ignites spontaneously upon exposure to the air and ignites the scattered filling of the bomb.

WARNING

The coarse white phosphorus in the igniter liquifies at 111°F and may leak through the filler plug if exposed to high temperatures. Leaking igniters can be determined by the presence of smoke and/or flame or by the presence of coarse white material on the igniter. If any of these conditions are observed, notify explosive ordnance disposal (EOD) personnel immediately.

M23 or AN-M23A1 IGNITER

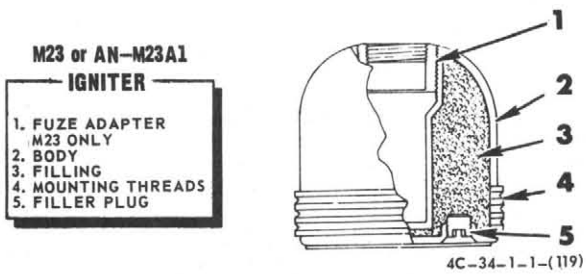


Figure 1-117

FMU-54/B TAIL FUZE

The FMU-54/B tail fuze is a mechanically operated retardation sensing device with a predetermined arming delay of 0.75 to 3.50 seconds, settable in 0.25 second intervals. The fuze is used for the tail fuze well of only the M117, and MK 82 bombs equipped with high drag (retardation) fins. Upon release, the fin causes rapid deceleration of the bomb, initiates the fuze arming cycle and provides a safe escape distance from delivery aircraft. In the event of fin malfunction, the fuze will not arm. A properly armed fuze will function upon impact when a G weight releases the spring-loaded firing pin. The fuze is mechanically initiated by a lanyard connected to the pylon swivel. As the bomb falls away, the lanyard pulls the fuze lanyard engaging shaft, thus releasing the fuze components to operate if proper retardation is experienced. The lanyard assembly is routed such that the lanyard will go with the bomb after performing its function.

Assembly and Installation

Upon removal of the tail fuze well plug, feed the free end of the lanyard through the tail fuze well, into the conduit, and out the bomb charging well. The lanyard assembly is seated in the fuze well. The lanyard lock is installed in the bomb charging well and held in place by the retaining ring. The lanyard is fed through the circular portion of the swivel assembly and through the key lock holes in the lanyard lock. The fuze is removed from the container, safety pin pulled (waterproofing pin inserted in its place) and inserted into the fuze well. Slight movement of the lanyard, protruding through the charging well indicates that the fuze has been seated. Rotate timing indicator counterclockwise one full turn and set to desired setting. If desired setting is passed, continue CCW rotation to the predetermined time setting. Install the rubber bumper in the bomb end cap recess and install the end cap.

Note

After fuze installation, the accompanying red warning tag should be filled in and attached to the bomb.

Compatibility

The FMU-54/B fuze is compatible with the tail fuze well of only the M117, and MK 82 GP bombs that are configured with high drag fins. Bombs using high drag fins but intended to be dropped in the low drag mode, require fuzing other than the FMU-54/B.

Normal Operating Sequence and Modes

As the bomb falls away from the aircraft, the lanyard pulls the fuze lanyard engaging shaft, thus releasing the fuze components to operate. With a retardation force of $3.5 \pm 0.5G$, the commit weight frees the main G-weight which moves to its full travel. The G-weight is connected to the timing block by two springs which pull the timing block through a delay assembly. Upon reaching the end of its travel, the timing block releases the timer verge locking pin allowing the timer to operate, thus arming the fuze in the pre-set period of time. The timing block takes 0.6 seconds to reach its full travel and if at any time during this 0.6 seconds retardation is lost, the G-weight reverts to its original position and does not arm the fuze. If the fuze has not armed prior to impact, a failsafe G-weight functions upon impact and allows a pin to block the path of the slider assembly to prevent arming. If the fuze has become armed during drop and if the firing pin G-weight is unlocked upon impact, the G-weight will slide forward to release the spring-loaded firing pin. The firing pin strikes the detonator and the explosive propagation continues through the lead cups to the booster.

Special Safety Features

a. The fuze requires a 0.6 second sustained G loading in the front to rear direction in order to arm. An initiated fuze can be subjected to repeated impacts from the front but will not arm unless the impacts are of 0.6 seconds or longer duration.

b. If fin failure occurs during fin opening, the retardation time is insufficient to arm the fuze.

c. If the fins have not functioned properly, the failsafe G-weight will function upon impact and prevent arming during retardation experienced during impact.

Operating Restrictions

The minimum release airspeed is 350 knots CAS for bombs used with the FMU-54/B Fuze. The maximum release airspeed is the limit imposed by the bomb and aircraft. Refer to T.O. 1F-4C-1.

Safe Escape

Safe escape criteria must be observed in the selection of FMU-54/B arming delay settings. Even though the fuze arming delay can be set to a value as low as 0.75 sec, a minimum setting of 2.5 sec must be used to assure safe escape during low level operations. Considering the MK 15 Mods 1, 2, 3 retarder (MK 82 Snakeye 1) and MAU-91A/B, B/B retarder (M117 Ret) opening times, this would require the selection of release conditions which will provide a minimum bomb time-of-flight of 2.8 sec. Fuze Arming and

Safe Escape tables which list the altitudes required for safe escape and FMU-54/B fuze arming (for the 2.5 second arming delay setting) are listed in section VI.

WARNING

To assure safe escape in the event of a premature airburst detonation, the FMU-54/B arming delay setting must be a minimum of 2.5 seconds.

Note

- The selected arming delay setting should be recorded on the red warning tag which is filled in and attached to the bomb when the loading is completed. This should be checked by the aircrew during the pre-flight of the aircraft.
- Since the fuze settings are not visible to the pilot for inspection, the munitions handling and loading personnel must be carefully briefed on the required settings and the red warning tag procedures.

FMU-54A/B TAIL FUZE

The FMU-54A/B is a modified version of the FMU-54/B (figure 1-117A). The major differences between the two fuzes are in the selectable safe separation times, and in provisions which enable the FMU-54A/B to be used in conjunction with a MK-43 Target Detecting Device (TDD). The fuze fits into the tail fuze well of M117 and MK-82 bombs equipped with a high-drag (retardation) fin. A safe-separation timer provides ground-settable delays of 2.5 to 6.0 seconds, settable in 0.25-second intervals.

The FMU-54A/B fuze can be used either alone or in conjunction with a MK-43 Target Detecting Device (TDD). When both units are used, the TDD electrically activates the FMU-54A/B fuze at a set function altitude above the ground. However, if the TDD is not used or does not provide a firing signal, the FMU-54A/B fuze will detonate the bomb at impact. During an armed release, the FMU-54A/B functions as follows:

a. When the cord assembly that is attached to the arming solenoid stretches to its elastic limit, the swivel and link assembly fails allowing the lanyard to retract into the internal plumbing and fall with the bomb, thus initiating the fuze arming cycle. The D ring of the swivel and link assembly remains with the aircraft.

b. The fin release pin is then withdrawn from the fin retaining band latch.

c. When the fin drag plates open, an arming wire attached to one drag plate is withdrawn from the striker rod in the MK-43 TDD. The fin drag plates provide stability and deceleration during bomb descent.

d. Sustained retardation of 4.0 G for 0.6 second causes the retardation sensor in the fuze to complete the sensing cycle and start mechanical timing sequence of 2.5 to 6.0 seconds arming time. At the end of the preset arming delay, the rotor release shaft permits the spring loaded rotor to move so that the detonator in the rotor is in line with the firing pin and the explosive lead in the fuze housing. The electrical detonator in the rotor is also in contact with the electrical leads to the MK-43 TDD. When the rotor is in line, the fuze is fully armed.

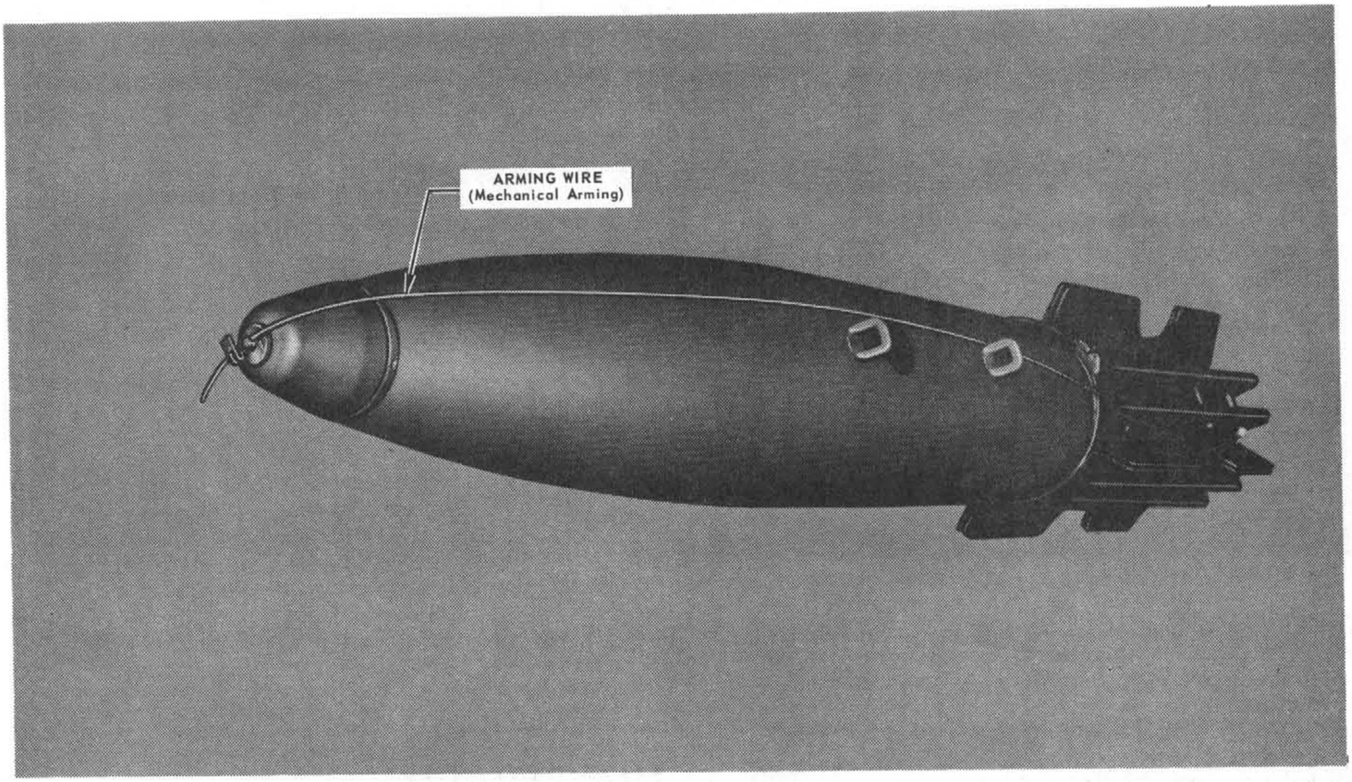
e. The MK-43 TDD is initiated by withdrawal of the arming wire from the striker rod. The spring loaded striker rod ignites the thermal battery through an electric pyrotechnic match. The thermal battery reaches its operating voltage in approximately 2 seconds. As the bomb approaches the target the interaction between the emitted and reflected radio frequency energy causes a doppler signal to appear at the oscillator detector. This signal is then applied to the target signal amplifier to be amplified sufficiently to trigger the thyratron in the firing circuit. Energy is thus applied to the electric detonator in the FMU-54A/B fuze and the bomb detonates.

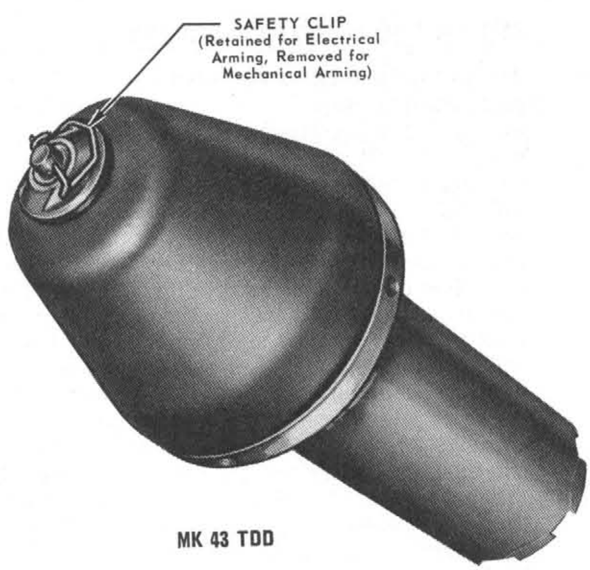
f. If the FMU-54A/B fuze is used alone or the MK-43 TDD fails to function, the spring loaded firing pin initiates the detonator at impact.

MK-43 TARGET DETECTING DEVICE

The MK-43 Target Detecting Device (TDD) is an electronic proximity sensor that provides an electrical signal to detonate the FMU-54A/B fuze (figure 1-117A). The TDD fits into the nose fuze well of

FMU-54A B TAIL FUZE & MK 43 TARGET DETECTING DEVICE





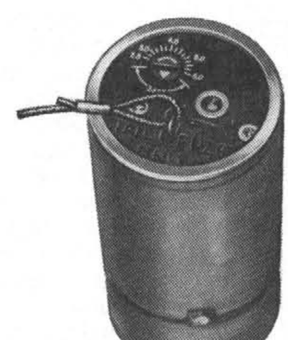


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Figure 1-117A

R.H.

M1 AND M1A1 FUZE EXTENDER

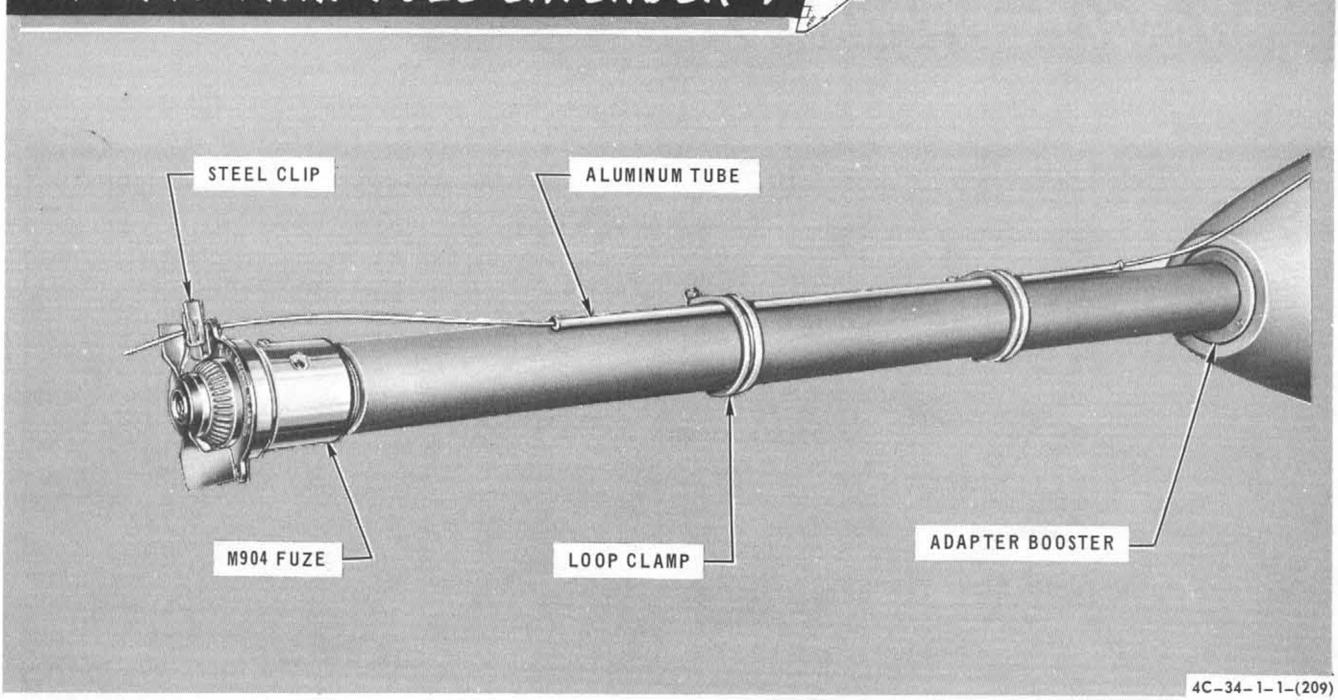

Figure 1-118

the M117 series and MK-82 series bomb. The TDD contains no explosive components. The nominal function height for the MK-43 is 16 feet.

The MK-43 TDD consists of a cylindrical metal body with a dark green plastic nose cone attached to the forward end. The battery initiating striker rod protrudes from the nose cone. This spring loaded striker rod protrudes from the nose cone. This spring loaded striker rod is held in place by a safety clip. A receptacle for an electrical connection is located at the rear of the cylindrical body. The TDD is initiated by withdrawal of the arming wire from the striker rod. This occurs when the high drag fin is deployed shortly after release. The spring loaded striker rod ignites the thermal battery through an electric pyrotechnic match. The thermal battery reaches operating voltage in approximately 2 seconds. The target signal amplifier output is fed to the radio frequency oscillator detector where pulsed radio frequency energy is radiated outward in a lobol pattern. As the bomb approaches the target, the interaction between the emitted and reflected radio frequency energy causes a doppler signal to appear at the oscillator detector. This signal is then applied to the target signal amplifier to be amplified sufficiently to trigger the thyratron in the firing circuit. Energy is then applied to the electric detonator in the FMU-54A/B bomb fuze which detonates the bomb.

FUZE EXTENDERS

M-1 AND M1A1 FUZE EXTENDERS

The fuze extension devices (figure 1-118) are physically compatible with T45 series nose adapter booster and any bomb which will accept M904E1, E2, E3 nose fuzes. It consists of a burster support and a burster assembly. The burster support is a steel tube 2.375 inches outside diameter which has a male thread at one end for attaching to the bomb, and T45 series nose adapter/booster and a female thread at the other end to receive nose fuze. The burster assembly consists of an asphalt impregnated chipboard which has a recessed metal cap crimped to one end and a plain metal cap cemented to the other. The tube is filled with cast tetrytol. The overall length of the burster support is 36.72 inches; burster assembly, 35.96 inches; designated size, 36 inches. The fuze extenders are authorized for use with the M118 GP, MK 82, MK 83, and MK 84 LDGP bombs. Only the M904 fuze is recommended. Three fuze extenders are available in 18-inch, 24-inch, and 36-inch lengths.

Until ballistic testing of the fuze extenders is accomplished and published, the existing bombing tables, fuze arming data and safe escape data should be used. Refer to T.O. 1F-4C-1 for load configuration and External Store Limitations on the bombs authorized to use the fuze extenders.

TRAINING WEAPONS AND EQUIPMENT

SUU-20/A, A/A, B/A, BOMB AND ROCKET DISPENSER

The SUU-20 practice bomb and rocket dispenser (figure 1-119) is an externally mounted pod which has both rocket launching and practice bomb ejection capabilities. Dispenser statistics are listed below.

a. Length: 122 inches
b. Width: 19.3 inches
c. Weight: 465 lbs. approximate (loaded with six 25-lb. practice bombs and four 2.75-inch rockets). Empty weight: 241 lbs.
d. Drag index: Full: 3.1
Empty: 3.7

The dispenser is designed to carry six practice bombs and four 2.75 inch FFAR rockets. The six practice bombs are carried in a recessed open bay and held in individual bomb ejector guns by retention arms and sway braces. The rockets are contained in four launch tubes, two tubes located on each side of the dispenser. The two left side launch tubes (1 and 2) are shown in figure 1-119.

The general differences between the various series dispensers are:

a. The SUU-20A/A and B/A have strengthened hard back to accept the force of an ejector foot when jettisoned.
b. The SUU-20A/A and B/A employ the use of ejector gun safety pins and SUU-20/A uses bomb retaining locks (figure 1-119) to safe the practice bombs prior to flight.
c. The SUU-20A/A and B/A have improved sway brace assemblies.

The bomb ejector gun is a rod-and-piston assembly, operated within a breech housing and driven by gas pressure that is produced from an electrically fired ejector cartridge. An ejection velocity of 21 feet per second for a 25-pound bomb is produced. A typical breech housing with a lock type safety pin installed is shown in figure 1-119. One end of the safety pin retaining cable is permanently secured to the dispenser and the other end containing the lock pin is inserted into the breech housing; therefore, when the breech mechanism and cartridges are not installed, the safety lock pins will be clearly visible as shown by the side view of the dispenser. On the SUU-20/A, additional bomb ground safety is obtained by bomb retention locks which are hooked to one retention arm, closed around the bomb, and secured with a red flagged safety pin to the other retention arm. Also, the bomb/rocket electrical circuit is safetied, thus preventing inadvertent stores release through activation of the dispenser intervalometers. This is accomplished by inserting a red flagged safety clip into the dispensers electrical circuit. When installed, the electrical safety flag will be visible at the rear end of the dispenser.

A typical preflight on the SUU-20/A dispenser reveals seven red flags and, if the ejector cartridges are not installed, six safety lock pins hanging from the bottom of the dispenser.

Note

Observation of the safety lock pins depends on whether the cartridges have been installed in the bomb ejector guns.

DISPENSER INTERVALOMETERS

Figure 1-119 shows two similar intervalometers located on the underside of the dispenser forward of the numbers 1 and 3 bomb dispenser stations. Note the rocket intervalometer is forward of the number 1 station while the bomb intervalometer is forward of the number 3 station. The only difference in the two intervalometers is the number of stepping positions for the ripple and single modes of operation. These positions conform to the number of bomb and rocket positions which are 6 and 4, respectively.

The 28 volt dc power required for dispenser operation is furnished by the weapon select switch and the master arm switch. When the master arm switch is in the ARM position, the bomb button transfer relay is energized, which routes the pickle signal from the bomb button to the aircraft intervalometer. Placing the weapon select switch to RKTS & DISP energizes a relay within the SUU-20 dispenser. This relay eliminates the requirement that both bomb and rocket circuitry be available at the dispenser carrying station (figure 1-120). This is accomplished by directing the firing pulses through this relay to the appropriate dispenser intervalometer. With the weapon selector knob on the desired mode, the dispenser relay completes the circuit to either the bomb or rocket intervalometer.

For clarity of text the modes of operation are covered in a SINGLE, RIPPLE and SALVO sequence and it is assumed that the initial release requirement is bombs, then rockets. It is also assumed the aircraft is configured with two dispensers, one mounted on each inboard wing station (stations 2 and 8).

The intervalometer modes of operation must be selected prior to flight. During preflight, the intervalometers are in the SAFE position just preceding the desired mode of operation. For example, if the mission requires SINGLE MODE operation the intervalometers would actually be set on SALVO SAFE. Therefore, when the intervalometers are armed, the switch will not track through any other mode. The SINGLE ARM position must be selected prior to flight.

Note

In the event a full bomb or rocket load is not carried, the bombs and rockets should be loaded in a manner that is compatible with the release sequence.

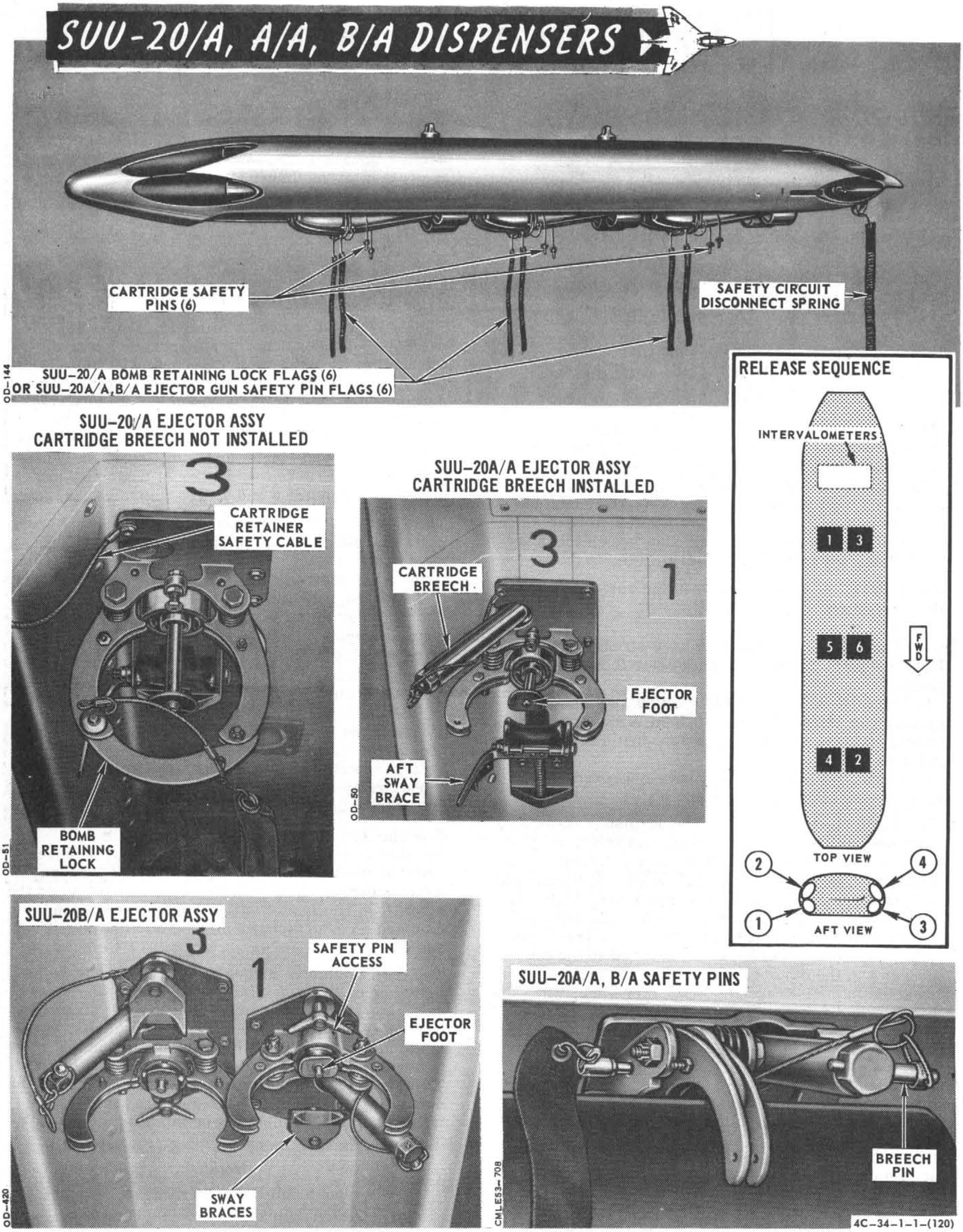
SUU-20/A, A/A, B/A DISPENSERS
CARTRIDGE SAFETY PINS (6)
SAFETY CIRCUIT DISCONNECT SPRING
SUU-20/A BOMB RETAINING LOCK FLAGS (6)
OR SUU-20A/A, B/A EJECTOR GUN SAFETY PIN FLAGS (6)
OD-144
SUU-20/A EJECTOR ASSY
CARTRIDGE BREECH NOT INSTALLED
3
CARTRIDGE RETAINER SAFETY CABLE
BOMB RETAINING LOCK
OD-51
SUU-20A/A EJECTOR ASSY
CARTRIDGE BREECH INSTALLED
3
1
CARTRIDGE BREECH
EJECTOR FOOT
AFT SWAY BRACE
OD-50
RELEASE SEQUENCE
INTERVALOMETERS
1 3
5 6
4 2
FWD
TOP VIEW
AFT VIEW
2
4
1
3
SUU-20B/A EJECTOR ASSY
3
1
SAFETY PIN ACCESS
EJECTOR FOOT
SWAY BRACES
OD-420
SUU-20A/A, B/A SAFETY PINS
BREECH PIN
CMLE53-708
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Figure 1-119

SUU-20/A, A/A, B/A FIRE CIRCUIT

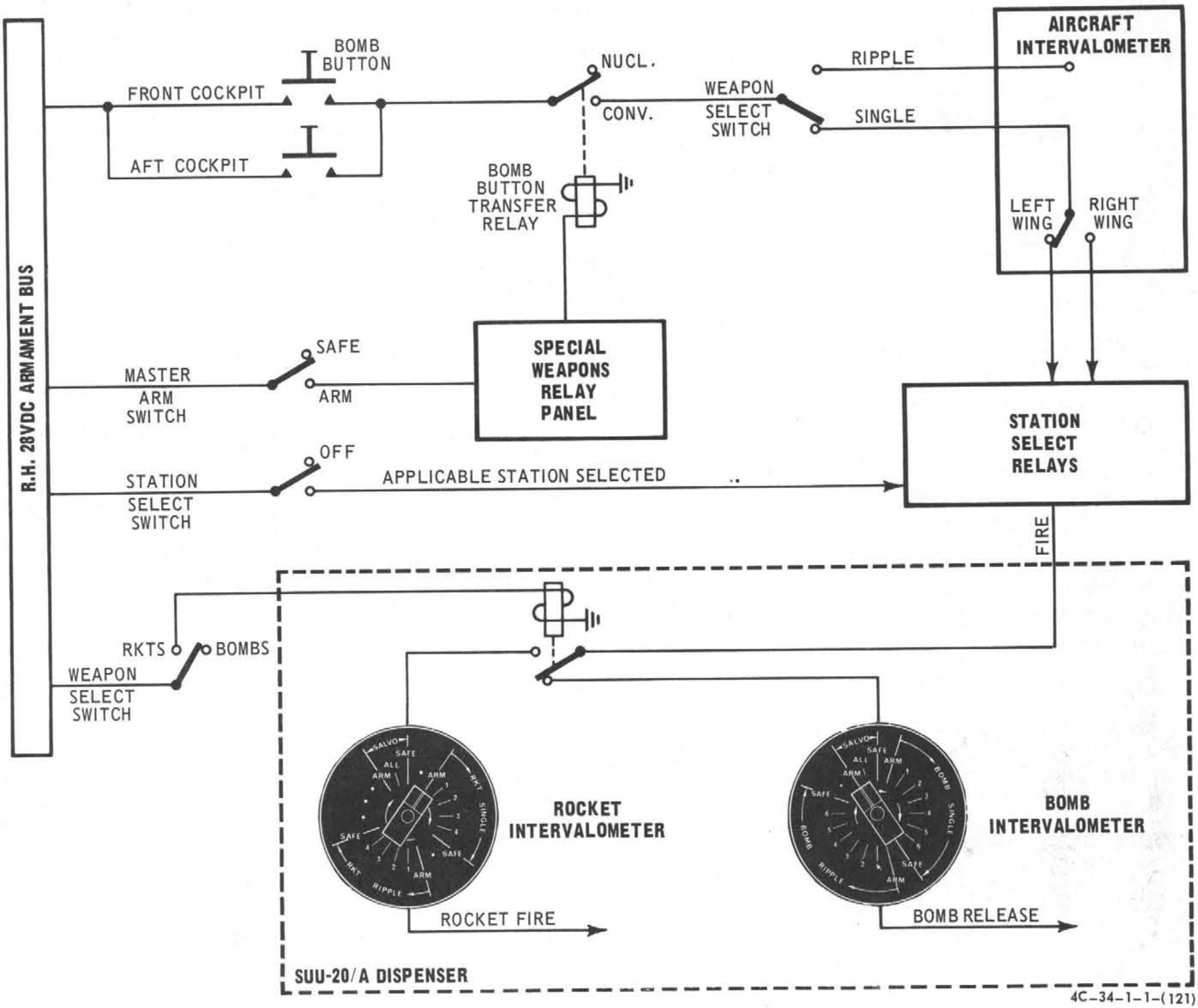


Figure 1-120

In addition to the single, ripple and salvo modes that are selectable within the SUU-20 dispenser, the aircraft cockpit selections are also available. Use of the weapon select knob on BOMBS/SINGLE/TRIPLE or RIPPLE and the aircraft intervalometer settings provide inflight cockpit selectivity. To obtain the capability, set the bomb intervalometer in the SUU-20 to BOMB SINGLE.

The SUU-20 intervalometer requires approximately 50 to 75 milliseconds to step from one station to the next. When the aircraft intervalometer is set to 60 milliseconds, the second pulse may reach the dispenser prior to stepping to station two. Therefore, if BOMBS TRIPPLE (F-4D/E) is selected in the cockpit, only two bombs may release from the dispenser. When BOMBS RIPPLE is selected, the bombs in the SUU-20 will release but the time intervals are twice that selected. To preclude these occurrences, use 0.10 and 0.14 aircraft intervalometer settings.

WARNING

(F-4C only) If the SUU-20 containing both rockets and bombs is aboard, and an empty TER is aboard the opposite station (2 and 8), applying the bomb release signal in a BOMBS PAIRS mode may also launch a rocket. The stepper circuits in the TER cause a feedback pulse which may be of sufficient duration to cause the rocket launch.

Use of the cockpit selection of RKTS & DISP/RIPPLE is authorized and may be used. However, the same

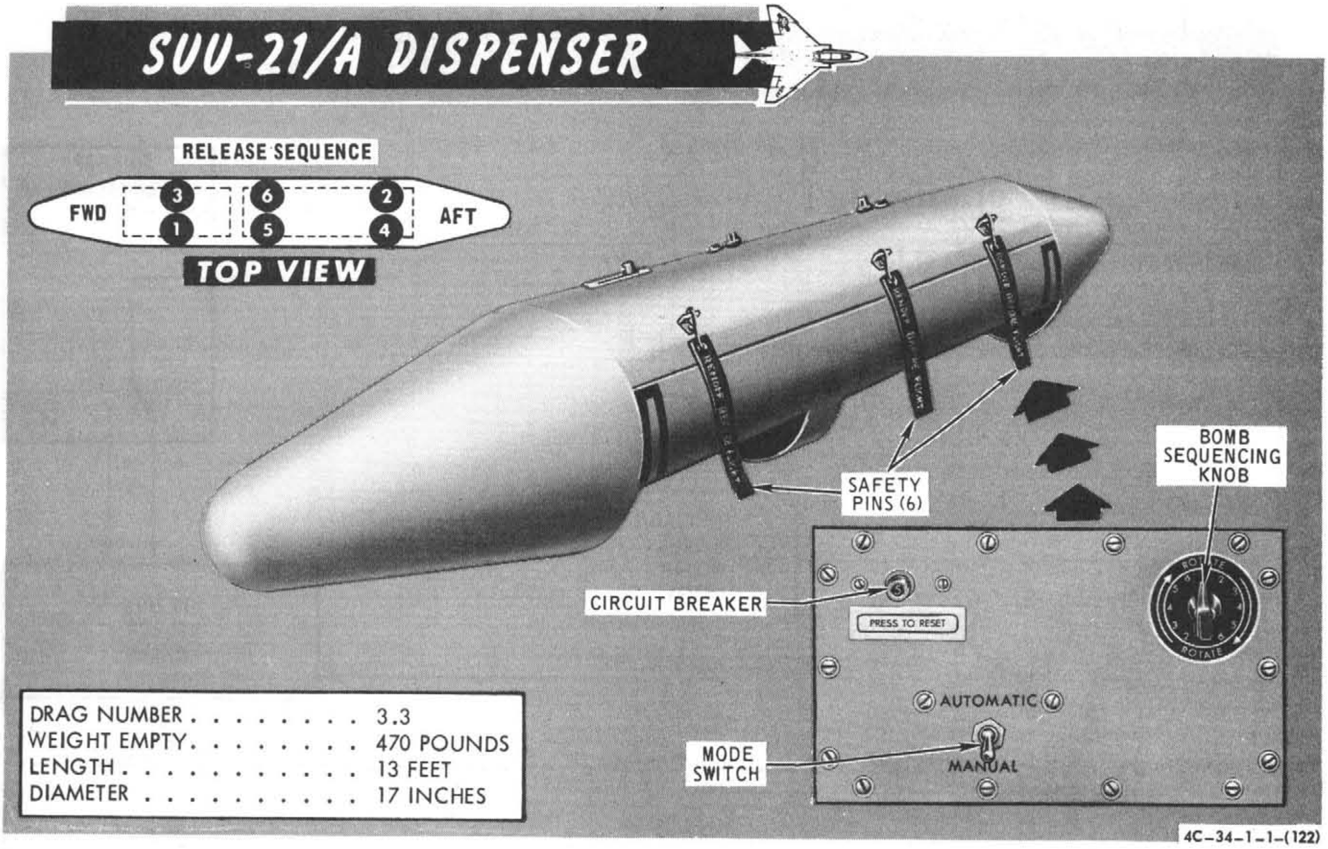


Figure 1-121

firing interval delay is present. Therefore, use aircraft intervalometer setting of 100 and 140 milliseconds only and set the SUU-20 rocket intervalometer to ROCKET SINGLE.

SINGLE MODE OPERATION

Single mode operation allows the AC to eject one bomb, or fire one rocket at a time. The AC has the option of selecting a single bomb release from the left dispenser, then the right dispenser, or a simultaneous single release from both dispensers (pairs). The release sequence for both bomb and rockets is shown in figure 1-119.

RIPPLE MODE OPERATION

The ripple mode of operation allows the AC to release bombs or fire rockets in a fixed 100 millisecond interval. The AC also has the option of selecting ripple capabilities from the left dispenser, then the right dispenser or both dispensers at the same time. The release sequence for both bombs and rockets is shown in figure 1-119.

Note

> The AC must hold the bomb button depressed for the duration of the RIPPLE sequence, which is approximately half a second.

SALVO MODE OPERATION

The salvo mode of operation gives the AC the capability of releasing all bombs or all rockets simultaneously. The dispenser relay directs the firing pulse through the dispenser (BOMBS or ROCKETS) to simultaneously release all six bombs or fire all four rockets.

SUU-21/A BOMB DISPENSER

The SUU-21/A bomb dispenser (formerly the MN-1A dispenser) (figure 1-121) contains six, spring-loaded ejector mechanisms, permitting up to six bomb releases during one sortie. The act of loading a practice bomb forces the ejector plunger upward, compressing a spring until toggle arms snap into a cocked position around the bomb, securing it to the ejector. As the ejector operates (cocking or releasing), an indicator pin extends from the side of the dispenser near the ejector being loaded, then retracts within the dispenser contour. A red flagged stop guard is inserted into a slot over the indicator pin hole to prevent release of a bomb-loaded ejector. The guards must be removed prior to flight. The bombs are released singularly in sequence determined by a circuit selector within the dispenser, but this release sequence can begin with any of the ejector positions by manually positioning the rotary switch on the dispenser relay box prior to takeoff.

Note

- For inboard carriage capability, the SUU-21/A dispenser is modified in accordance with T.O. 11N-PD-SUU-21/A-504.
- Some organizations may have modified SUU-21 dispensers, which are operated through the converntional weapons controls on the pedestal panel (F-4C/D/E). The dispensers are carried only on the inboard stations. Aircrew procedures for these dispensers are available in section II.

The 28 volt dc current required for dispenser operation is furnished by the DCU-94/A control-monitor, and the aircraft release systems. Dispenser continuity is monitored, and bomb bay door operation is

controlled through the DCU-94/A control-monitor. Placing the option selector knob to SAFE, and then depressing the bomb test button illuminates the loaded station WARN light to verify aircraft/dispenser electrical continuity. (Assume here that the dispenser doors are closed.) This check verifies that only two of the electrical connectors are properly installed. The remaining (rack primary) plug, which powers the dispenser release relay at bomb release, is not included in the bomb test circuit. If the doors are open when the AC selects SAFE as described, the doors will close - regardless of the position of the station select switch and the nuclear store consent switch. To power the door-open and automatic-close functions, however, the loaded station select and consent switches must be energized and the DCU-94/A option switch must be positioned to GND or AIR. The consent switch must be placed on REL/ARM. This directs 28 vdc main bus power to the door-open side of the door actuator. The WARN light flashes during door travel, and illuminates steadily when the doors fully open. When the doors fully open, an interlock switch is closed, completing the dispenser release circuit. The AC energizes the master release lock switch and selects the desired bombing mode to release a single bomb.

To illustrate the SUU-21/A door functions with respect to switching procedure on the DCU-94/A, suppose the aircrew enters the cockpit for the mission while the loaded dispenser doors are open. Also, suppose that all armament switches are deenergized with the exception of the option selector, which is positioned on either SAFE, GND or AIR. As soon as the 28 volt dc essential bus is energized (external power applied or during engine start) the dispenser doors will close. To keep the doors open, the aircrew must select either: (1) the OFF position on the option selector; or (2) the GND or AIR position and place the applicable station select switch forward, and place the consent switch to REL/ARM prior to applying essential bus power. Then, as power is available in either case, the pilot selects SAFE to close the doors. These functions are independent of the position of the mode switch located on the dispenser relay box which is discussed below.

AUTOMATIC MODE

The automatic door-close function is selected by the mode switch on the dispenser relay box (figure 1-121). When the bomb button is depressed, with the mode switch positioned on AUTOMATIC, power from the bomb button energizes relays that remove voltage from the door-open coil of the door actuator, and the doors begin to close automatically as a single bomb is released. The WARN light flashes as the doors close, and goes off as the doors fully close. The AC reopens the doors by moving the option switch (from GND) to SAFE, and back to GND. This procedure is performed after each bomb release to reopen the doors. The AC may close the doors any time (without releasing a bomb) by selecting SAFE on the option switch.

Note

The aircrew may close the doors by placing the nuclear store consent switch on SAFE, or the loaded station select switch to the AFT position. If the consent switch is used, the WARN light will remain illuminated throughout the door cycle. If the loaded station switch is used, the light will function normally.

MANUAL MODE

With MANUAL selected, those relays which govern automatic operation (above) are not energized as bomb release voltage is applied. Hence, the doors remain open until the AC elects to close them by selecting SAFE on the DCU-94/A.

Note

Although the dispenser doors may remain open continually, the unit is susceptible to low frequency vibrations that may cause structural damage. When operating in the manual mode, it is recommended that the doors remain open only while the aircraft is on the bombing range, and closed during all other periods of flight. Each dispenser should be inspected periodically according to procedures specified by the appropriate command.

INTERLOCK CONTROLS

The dispenser doors are opened and the release circuit is unlocked by first positioning three interlock switches. With the option switch on SAFE, the loaded station select switch is placed forward, and the nuclear store consent switch is placed to REL/ARM. The doors will now open by selecting GRD on the option switch. The REL position of the consent switch serves no purpose with the dispenser aboard. These functions receive 28 vdc power through the AMAC circuit breaker.

The fire circuit is unlocked by actuating the consent switch and the station select switch as indicated above, and then by moving the master release lock switch to the forward position. The loaded station UNLOCK light now illuminates, indicating the readiness of the release circuit. The AC may release a single bomb button, provided a specific bomb mode has been selected on the bomb control panel.

Note

The UNLOCKED light will come on if the nuclear store consent switch is in REL; however, the REL/ARM position must be engaged to complete the arm circuit and open the bomb bay doors.

DCU-94/A CONTROL-MONITOR

The DCU-94/A control-monitor (figure 1-43) is located on the AC right console. Power is available for

the panel from the 28 vdc essential bus. The panel contains controls that energize the bomb arming (dispenser door opening) circuit, and the bomb release circuit.

The option selector knob has four positions: OFF, SAFE, BOMB-GRD, and BOMB-AIR. The AIR position may be ignored for non-nuclear delivery; selecting AIR will perform the same function as the GRD position. The option switch is guarded by a control arm limiting its movement to the OFF and SAFE positions. The control arm must be moved from OS (OFF-SAFE) to S-ARM (SAFE-ARM) before the knob can be positioned to GRD. In OFF, all power is removed from the dispenser. Selecting the SAFE position powers the centerline WARN light bomb test circuit, provided that the dispenser stub cable assembly is properly connected. The GRD position energizes the door actuators, provided the interlock controls are energized. When the doors fully open, the CL Warn light illuminates steadily.

With the SUU-21/A dispenser aboard, selecting the SAFE position powers the dispenser manual door-close circuit, and the dispenser/Warn light monitoring functions. The GND (and AIR) position directs main bus 28 vdc power to the door-open and automatic door-close circuits, provided the interlock controls are energized.

Note

> An attempt to force the movement of the option selector control arm can damage the option selector/control arm assembly and render the locking functions useless. The control arm should be positioned only when the option selector is in the SAFE position.

The CL UNLOCK light monitors the CL fire relay; the wing station UNLOCK lights monitor the MAU-12 unlock solenoids. The SUU-21 release circuit is energized through the following controls.

a. Master release lock switch - FORWARD
b. Wing/CL station select switch - FORWARD
   (1) Wing station UNLOCK light - ON
c. (P) Nuclear store consent switch - REL/ARM
   (1) CL station UNLOCK light - ON

If the MAU-12 inflight lockout bolts are installed, the wing station UNLOCK lights are illuminated continuously.

Note

- If other munitions are loaded on the CL station with the SUU-21 on a wing station, a CL station select switch guard should be installed on the DCU-92/A to prevent inadvertent jettison of the CL load. Also, switch guards may be applied to the wing stations.
- The SUU-21/A release sequence when all stations are selected is as follows: CL, LI, RI.

The lamp test button is a pushbutton switch that permits a functional check of all the warning and unlocked lamps on the DCU-94/A control-monitor. The button is functional when 28 vdc essential bus power is available.

The bomb test button is a pushbutton switch used to check electrical continuity between the dispenser and the DUC-94/A control-monitor. The button is functional to perform the continuity check when the option selector is in the safe position, and with 28 vdc essential bus power available to the DCU-94/A panel.

PRACTICE BOMBS

BDU-33 SERIES PRACTICE BOMBS

The BDU-33 Series Practice Bomb (figure 1-122) has an elongated, tear-drop shaped body and a fin assembly welded to a center tube. A conical after body is welded to the center tube and roll crimped into two grooves on aft end of bomb body. A firing pin assembly, signal cartridge and/or signal cartridge and inertia tube are inserted into the bomb and retained by a cotter pin. Upon impact the firing pin strikes the primer of the signal cartridge, detonating the signal producing a flash and smoke cloud to provide a visual point of impact.

Difference Data

BDU-33/B - Shrouded Fin, Signal Cartridge and firing pin assembly inserted in nose end of practice bomb.

BDU-33A/B - Cruciform type Fin, firing pin assembly, signal cartridge and inertia tube inserted in tail end of practice bomb. The ballistics differ sufficiently to require a separate set of bombing tables in T.O. 1F-4C-34-1-2, one set for the SUU-20/A bomb and rocket dispenser and one set for the SUU-21/A bomb dispenser.

BDU-33B/B - Same as BDU-33A/B with exception of safety device (cotter pin and tag) which is inserted between firing pin and signal cartridge during buildup and handling, prior to flight.

Physical Characteristics

a. Weight	24 pounds
b. Length	23 inches
c. Diameter	4 inches

MK 106 PRACTICE BOMB

The high drag MK 106 practice bomb (figure 1-122) is constructed of steel, weighs 5 pounds, is 19 inches in length and 4 inches in diameter. The bomb is composed of an inner cylinder, an outer cylinder, and fin assembly. The bomb utilizes the MK 4 Mod 3 bomb spotting charge installed into the inner cylinder. A box type fin assembly, consisting of four metal vanes welded together, is welded to the aft end of the inner cylinder. One of two indexing holes in the bomb mate with the indexing pin in the bomb ejector saddle pad when the bomb is loaded in the SUU-21/A dispenser. Each has a plunger safety clip which must be removed before flight.

Note

> The MK 106 practice bomb is authorized for use with the SUU-20/A practice bomb and rocket dispenser after the ejector foot pad is modified to prevent distortion of the bomb during ejection.

PRACTICE BOMBS

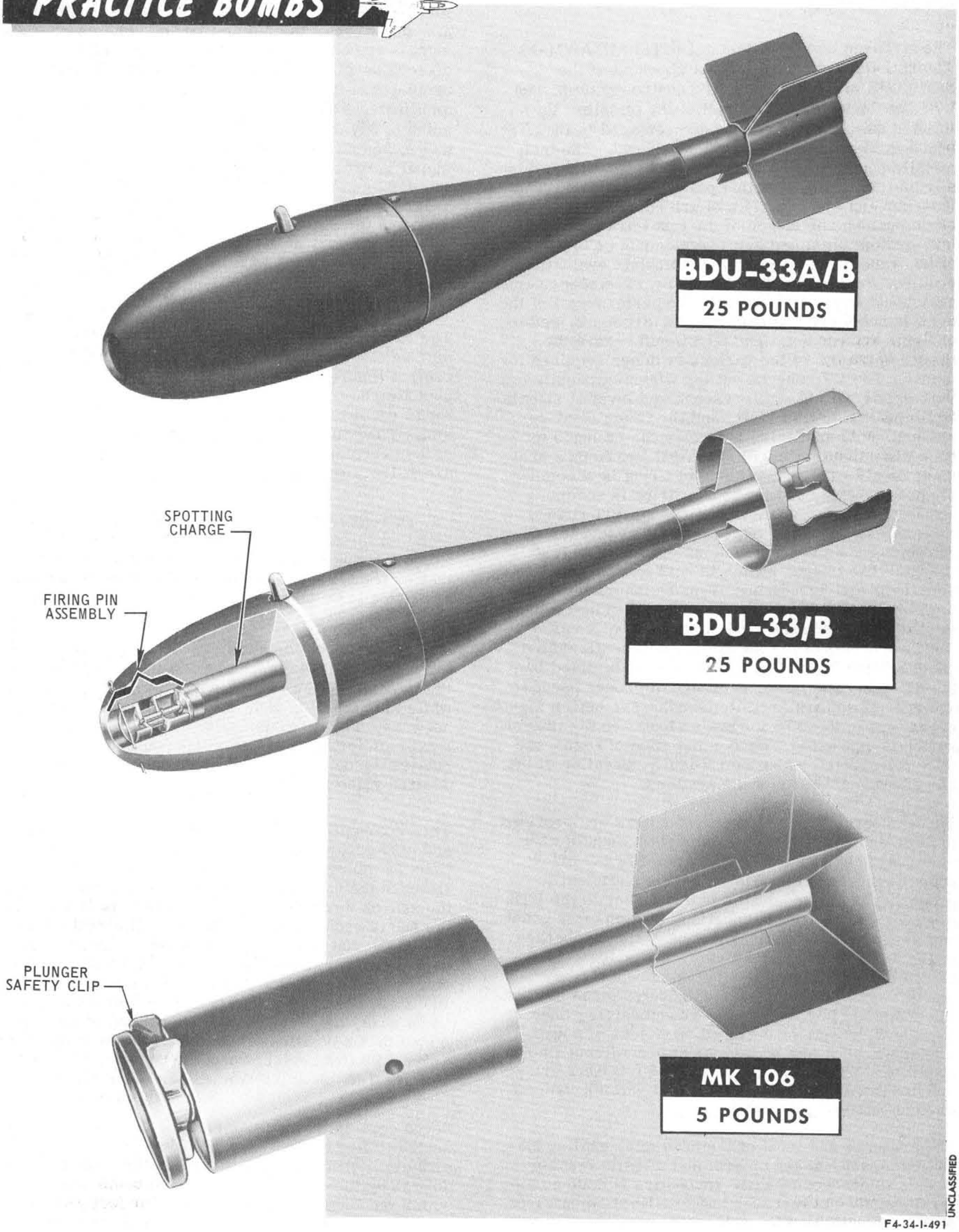


Figure 1-122

UMBILICAL TEST SET (UTS) AN/AWM-19

The airborne umbilical test set (UTS) AN/AWM-19 (figure 1-123) provides inflight checkout of the AIM-7D/E missile and the fire control system. The UTS becomes an integral part of the missile: the missile warhead is removed and replaced by the UTS, which is identical in size to the warhead. The test missile containing the UTS can be loaded on any missile station to checkout that particular station. The launcher and eject cartridges are removed to preclude jettison and launch of the test missile. The UTS provides nine indicators which can be used for crew evaluation. To provide a complete evaluation requires the use of a scope camera. The scope camera should be used to evaluate the performance of the crew in acquiring and tracking the target and method of flying the aim dot. The UTS would record the proper operation of the various switches required for launch. The UTS checks out the wiring continuity to the missile station, the presence and level of signals from the FCS and aircraft, and the firing relay operation. Four test missile firings can be made for each test missile aboard. The first two firings are made on a live target. The third firing is accomplished in BIT 6, and the fourth firing is accomplished in BIT 3. The third and fourth BIT firings are made to check the tester operation, and to validate indications received during the first two test firings. The trigger switch is held for 5 seconds to culminate each test firing. If more than one test missile is aboard, the normal missile firing sequence is observed (live AIM-7D/E are not usually carried when a test missile is aboard). The missile status panel SELECT and READY lights must be noted by the AC to determine the presence of proper pseudo and rear rf signals (missile tuned). The launch signal is sent to the UTS for evaluation when the trigger switch is depressed. Upon completion of flight, the UTS is inspected to determine faulty operation of the circuits or capability of the systems.

Three separate rows of event indicators are provided to allow independent testing of certain signals when operating against a live target or in BIT 6. BIT 6 supplies inputs to the FCS which are sufficient to properly check almost all functions going to the UTS. However, there are two functions (switch after boost and sweep select) which cannot be properly checked in BIT 6. Therefore, a fourth firing in BIT 3 is required to check out these functions properly: a fourth row of indicators accommodates these signals. The magnetic latching type event indicators, once energized, remains energized after loss of power. The appearance of a white indicator confirms a go condition. The SWP SEL and SW AFT BOOST are functional with the AIM-7E only and will not indicate when an AIM-7D is aboard.

The presence and level of the head aim, english bias, roll command, sweep control and missile recycle signals is checked by their respective voltage comparators. The preset high and low-limit comparison signals are supplied to each comparator through a missile station select switch which is set to correspond to the actual aircraft missile launching station under test. The presence of a simulated doppler signal is checked by a doppler detector. Presence and amplitude of the motor fire and eject and jettison signals are checked by their respective threshold detectors. Missile power is processed through a three-phase fault detector which checks for proper amplitude. The remaining signals (hub hydraulic actuate, klystron tuner limit and AFC, altitude 1 and 2, and Grounds A and B) await +28 vdc launch signal in order to energize their event indicators. The UTS indicator and controls are shown in figure 1-123. The first eight indicators (left of the vertical line) and the Swp Sel indicator (fourth row) are used for aircrew evaluation. Figure 1-123 states the purpose and use of each UTS indicator and control.

RADAR SCOPE CAMERA

The radar recording system is comprised of a still picture camera, a periscope assembly, and a camera control (figure 1-124). The system automatically photographs the radar scope display, keeping a continual record of radar presentations during the mission. The photo-optical arrangement and the design of the periscope assembly is generally shown in figure 1-125. The functions of these units are as follows:

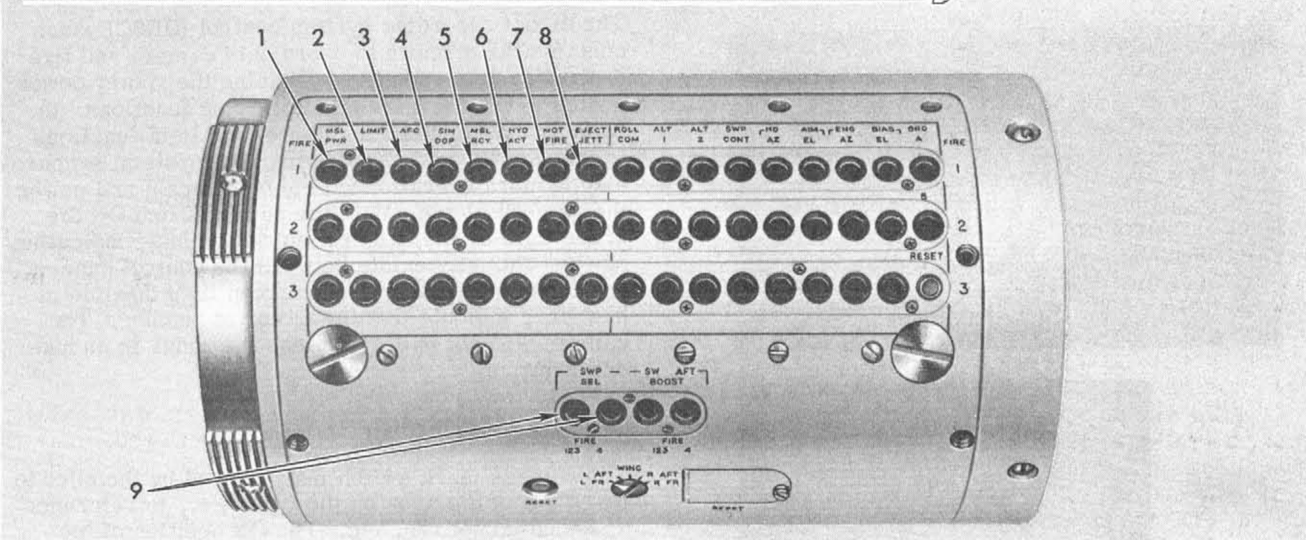
a. To reflect the radar display to the camera and transmit the display to the pilot.
b. To attenuate any light from an outside source that may enter the periscope and degrade the quality of picture to be taken.

The optical theory is not discussed here, but in general, the polarized lenses enable the pilot to adjust the intensity of the video display to a desired level, while the amount of light reaching the camera does not vary. The radar intensity control is set to a maximum for camera operations, and then the pilot rotates the outer filter on the periscope to obtain a desired video level.

The photo-optical system records the radar display, and also records various fire control system functions by momentarily illuminating small correlator lights in the camera. With the radar operating in the search mode, a picture is automatically taken at the end of each B-azimuth sweep or MAP PPI sweep. The pulse that momentarily opens the shutter to expose the film is synchronized with the antenna azimuth position. During lock-on, track, boresight, or BIT 2, 3, 5 or 6 operations, where there is no antenna scan, the pictures are taken at a rate determined by the position of the rate selector knob, placarded FPS (frames per second), on the camera control panel (from 2 to 6 frames per second).

Seven correlator lights, inside the camera, are connected to fire control system and armaments system circuits. When illuminated, the lights expose small dots along the edge of the film to mark an occurrence within the fire control or armament system. The position and meaning of each light - when illuminated - is shown in figure 1-126.

UMBILICAL TEST SET AN/AWM-19



AIRCREW EVALUATION			
AC FUNCTION CHECKED	**UTS INDICATOR**	**OTHER INDICATIONS**	**REMARKS**
1. Missile power sw - RADAR STBY			
2. Missile arm sw - SAFE 3. Missile select sw - RADAR			These functions are indicated as noted in items 6 and 7.
4. Missile interlock sw - IN			Interlocks must be in for meaningful results.
5. Missile power sw - PWR ON	2 LIMIT 3 AFC	SELECTED light ON	No flag if HEAT is selected.
6. Missile arm sw - ARM	4 SIM DOP	READY light ON	
7. Missile arm sw positioned to ARM in proper sequence.	5 MSL RCY		Flag will appear if ARM was selected after SELECTED light ON. No flag if ARM was selected early.
8. Trigger sw. - DEPRESS 5 SECONDS.	1 MSL PWR 6 HYD ACT 7 MOT FIRE 8 EJECT JETT	SELECTED and READY lights OUT	Lights go out after trigger is released. No flag if HEAT was selected.
9. AC Technique		Scope Camera	Will evaluate performance in flying the aim dot etc.
PILOT FUNCTION CHECKED			No flag on 6 7 or 8 if MISSILE FIRING circuit breaker is OUT
1. Circuit Breakers - IN			
2. Radar power sw - OPR		Scope Camera	
3. Gate sw - NAR	9 SWP SEL		Only one flag available. during the first two firings.
4. Radar mode sw - RDR		Scope Camera	
5. Polarization sw - CIR 1 or LIN			No indication available.
6. Target tracking		Scope Camera	
7. Target Lock-on		Scope Camera	Will show a steady ASE circle if HEAT is selected, or a varying ASE circle if RADAR is selected.

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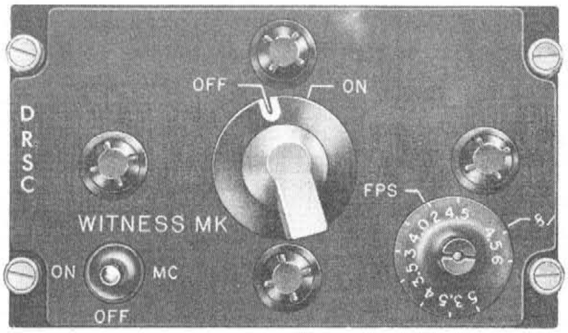
Figure 1-123

DRSC PANEL F-4C F-4D



F-4E

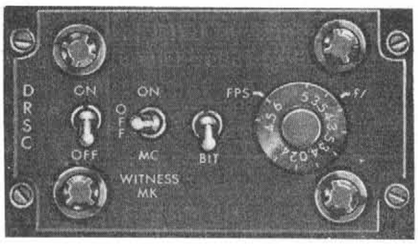


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Figure 1-124

THE CAMERA

The camera uses a standard 16 mm Kodak film magazine with 50 foot capacity. The film magazine is loaded into a receiver on the inner face of the camera door (figure 1-125). With the film properly inserted and the camera door closed, the camera gear train engages the magazine drive assembly. Also, the magazine pushes against a switch - opening the circuit to the film remaining (amber) light and closing the circuit to the camera clutch. Door opening and closing procedures, and the film loading operations should be handled gently so that camera boresighting is not disturbed. A small microswitch assembly, that completes the circuit to the amber light during camera operation, is preset to illuminate the light when 0 to 15 feet of unexposed film remains in the magazine. If the camera door is opened before the film reaches the preset film-remaining value, the microswitch assembly will reset to the starting position. Hence, the door should not be opened after the film has been advanced unless the magazine is to be removed entirely.

The green light, adjacent to the amber film-remaining light, illuminates to indicate power continuity in the camera circuits when the pilot places the power switch ON. The green camera power light receives power from the 28/14 volt ac bus and is controlled by the DIM/BRIGHT rheostat control knob. This light does not indicate the motor is actually running; however, by touching the camera case as power is applied, the pilot may be able to detect motor vibrations.

CAMERA CONTROL PANEL

Power Switch

The direct recording system control (DRSC) panel contains the circuits to coordinate camera and fire control system operation. Placing the rotary power switch to ON energizes the following functions: the camera motor, links the correlator light functions to those of the radar and armament system; synchronize camera operation with antenna scan; and power the camera clutch. With the power switch ON the green light on the camera must illuminate indicating power continuity exists between the control panel and the camera motor. The green light does not, however, indicate that the motor is running. The camera will not operate unless the radar is on and operating.

Witness Mark Switch

The witness mark switch may be used by the pilot to mark a specific area on the film, i.e., to reference a second target run, etc. The ON position of the switch illuminates correlator light No. 7 continually. The MC (momentary contact) position energizes a single flash illumination. Since the No. 7 light is on steadily during radar expanded sweep operation (F-4C/D) and when AIM-7D/E missile is gone (F-4E), it may be difficult to determine the difference between expanded sweep (missile gone) and the ON function of the switch when viewing the film. Hence, the MC position provides the most feasible function.

Acquisition Rate Selector

The acquisition rate selector knob is a five position knob which is used to select the desired film speed from 2 to 6 frames per second (FPS) when operating in a lock-on, track, boresight or BIT 2, 3, 5 or 6. As the film speed is selected, the correct aperture setting (f/stop) may be read on the opposite side of the control. The f/stop value is for reference only since the aperture is preset during ground operations. The optimum FPS setting is 4 and the optimum f/stop (as set on the ground) is 2.7.

BIT Switch (F-4E Only)

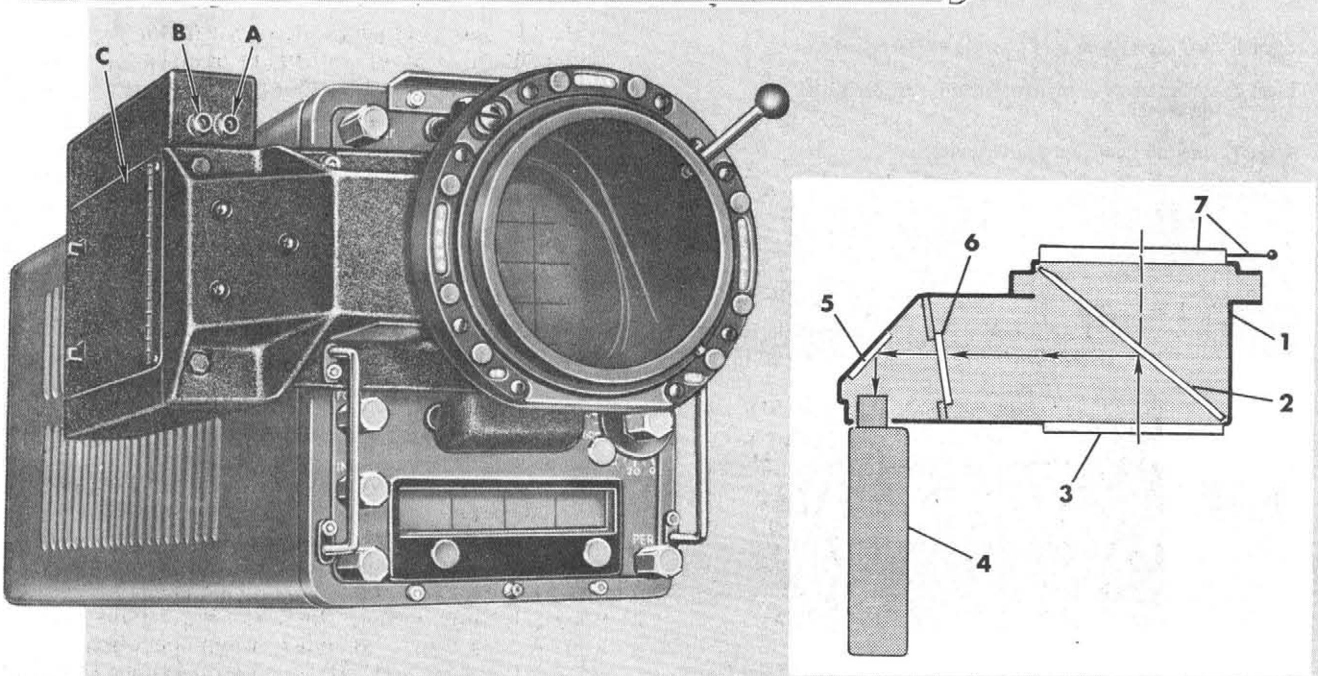
This switch is used by the ground crew for testing the camera operation and the seven correlator lights.

AIM-4D TRAINING MISSILE

The AIM-4D training missile is a captive training device used to train the aircrew in the use of the AIM-4D missile, in target tone detection, and in tactics. The preflight and inflight switch positions of the live missile and the training missile are the same. The training missile can be suspended from any one of the AIM-4D missile launchers. The igniter cable is connected.

The training missile consists of a modified AIM-4D guidance unit, a close-cycle cryogenic cooler, and a six-channel event recorder. During a single pass the following events are recorded (1) IR seeker

CAMERA AND PERISCOPE ASSEMBLY



A. MOTOR POWER LIGHT (GREEN)
B. FILM REMAINING LIGHT (AMBER)
C. CAMERA DOOR

1. PERISCOPE ASSEMBLY
2. BEAM SPLITTER (POLARIZED)
3. RADAR INDICATOR
4. CAMERA
5. MIRROR
6. INTERNAL POLARIZED FILTER
7. OUTER POLARIZED FILTER AND LEVER CONTROL

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Figure 1-125

slaved to radar antenna (2) tone received (3) IR seeker self-track (4) trigger pulled, and (5) simulated motor ignition. (The sixth channel is a spare.) Up to 20 minutes can be recorded.

During preflight the recorder, located aft of the missile stabilizers, should be checked to determine that a cartridge of paper is installed. The inflight procedures and tone indications are the same as the AIM-4D missile. For this reason, separate checklist procedures are not provided for the training missile. The training missile is recycled automatically when the trigger is pulled or by depressing the ARR button 2 minutes after the pass is initiated. The events are recorded on a paper cartridge and developed by exposure to sunlight or fluorescant light for several minutes.

WARNING

To prevent inadvertent firing of a live missile, a mixed load of live and training missiles should not be carried.

TDU-11/B TARGET ROCKET (5-INCH HVAR)

The TDU-11/B target rocket (figure 1-127) is a modified 5-inch HVAR (High Velocity Aircraft Rocket). Four tracking flares have been added to the rocket tail fins to increase the emitted infrared energy to produce a stronger target for the AIM-9B Sidewinder missile. The rocket is carried and fired from the same launcher as the AIM-9B missile - the LAU-7/A launcher. The firing signal is received through an electrical cable (rocket pigtail) that is plugged into and taped to the LAU-7/A launcher.

The TDU-11/B target rocket is selected and launched in the same manner as the AIM-9B missile. The target rockets and missiles should be loaded such that the AIM-9B is selected automatically after the target rocket is fired. This is accomplished if the target rockets are loaded on the left wing station and the AIM-9's are loaded on the right wing station. If the target rocket should fail to leave the rail within 3 seconds after the trigger switch is pulled, the target rocket and the next AIM-9B missile should be stepped over to prepare for the firing of the second

CORRELATOR LIGHTS

F-4C F-4D

Light 1 – Indicates AI radar is in heavy clutter operation.

Light 2 – Indicates AI is armed and that the trigger switch is depressed.

Light 3 – Indicates hold altitude light is on.

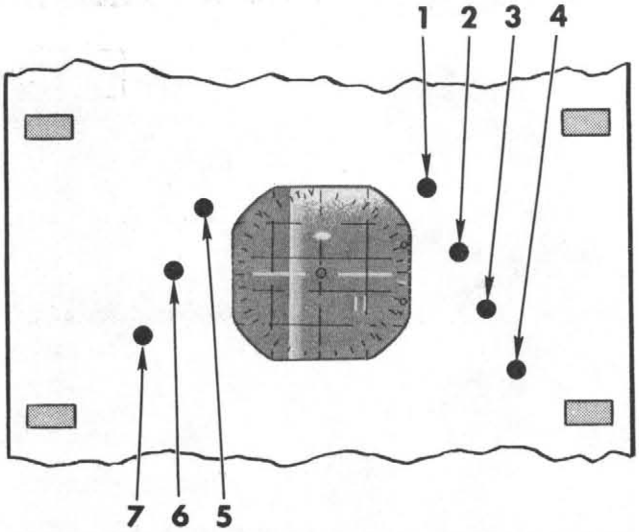
Light 4 – With the light on:
(a) With acquisition symbol on scope -- R1 or R2 was selected.
(b) Without the acquisition symbol on scope -- R4 was selected.

With the light off:
(a) With acquisition symbol on scope -- R3 was selected.
(b) Without acquisition symbol on scope -- R5 was selected.

Light 5 – Indicates AIM-7D/E missile gone.

Light 6 – Not used (IR system).

Light 7 – Indicates expanded sweep operation or that the Witness MK switch is ON.



F-4E

Light 1 – With light on:
Indicates R6 range if light 4 is on and R5 range if light 4 is off.

With light off:
Indicates R4 range if lights 3 and 4 are off.

Light 2 – With light on:
Indicates AI is armed and trigger switch is depressed.

With light off:
Indicates AI is not armed and trigger switch is not depressed.

Light 3 – With light on:
Indicates R1 range if light 4 is on and R3 range if light 4 is off.

With light off:
Indicates R4 range if lights 1 and 4 are off.

Light 4 – With light on:
Indicates R1 range if light 3 is on, R6 range if light 1 is on, and R2 range if lights 1 and 3 are off.

With light off:
Indicates R4 range if lights 1 and 3 are off.

Light 5 – With light on:
Indicates radar is in special mode (TRACK).

With light off:
Indicates radar is not in special mode (TRACK).

Light 6 – With light on:
Indicates radar set is in high PRF operation.

With light off:
Indicates radar set is in low PRF operation.

Light 7 – With light on:
Indicates AIM-7D/E missile is gone or that witness mark switch is ON.

With light off:
Indicates AIM-7D/E missile is not gone or that witness mark switch is OFF.

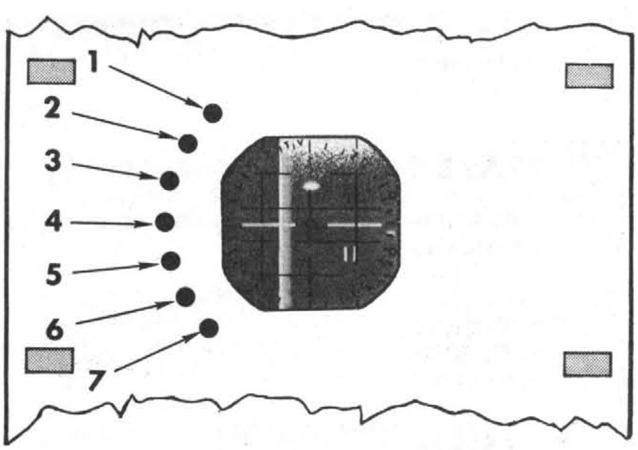


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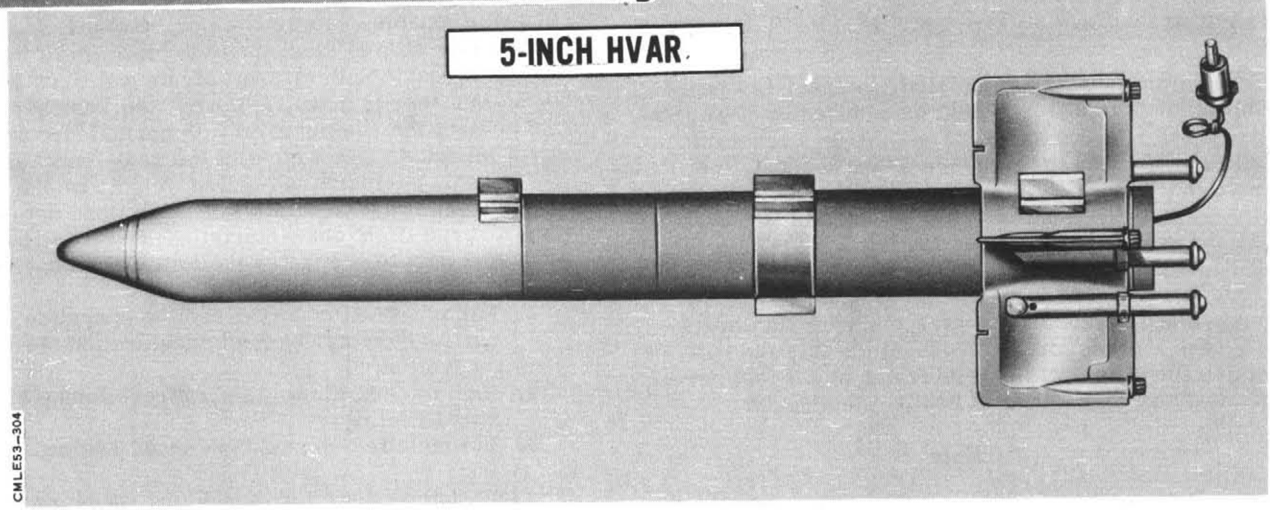
Figure 1-126

TDU-11/B TARGET ROCKET



WEIGHT	215 POUNDS
LENGTH	6 FT., 3 IN.
DIAMETER	5 INCHES
FLIGHT LIMIT	Refer to T.O. 1F-4C-1
ROCKET HEAD	LEADFILLED MK6, MOD 1

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Figure 1-127

target rocket. This is accomplished by actuating the missile selector switch to HEAT REJECT as necessary and observing the SW light on the missile control panel.

TDD-22A/B TOW TARGET

The TDU-22A/B tow target is towed from the RMU-8/A reel launcher. The target is capable of carrying four flares. Flare ignition is accomplished by a transmission from the UHF radio in the aircraft. For TDU-22A/B target flare ignition procedures, refer to section II, RMU-8/A tow target system. For an illustration of the target, refer to T.O. 1F-4C-34-1-1A.

TOW SYSTEM (RMU-8/A)

The tow system is a semi-automatic tow reel and target launching mechanism designed for use in target towing from high performance aircraft. The system is capable of trailing a 20 to 240 pound target on 40,000 feet of towline in approximately 8 minutes after initiation of the launch sequence. The tow system consists of a ram air turbine powered reel-launcher, control panels, towlines, and a target. The reel-launcher is mounted on the centerline station of the aircraft. Operation of the reel-launcher includes four operating cycles: launch, reel-out, reel-in, and recovery. Each of the operating cycles are outlined below along with flight recommendations.

LAUNCH

During launch, the target is lowered away from the reel-launcher on a launching boom. The target separates from the launcher and is reeled away from the aircraft at about 300 feet per minute to a preset distance of 200 feet. The launcher then automatically retracts to the reel. Target launch should be initiated at 300 KCAS at an altitude of 15,000 to 20,000 feet in a straight-and-level attitude.

REEL-OUT

The reel-out operation begins when the launcher is retracted. As the reel-out speed is increased to 4775 - 5220 feet per minute at an acceleration rate of 2.1 feet per second, the AC may begin a climb to mission altitude. A climb speed of 300 - 320 KCAS or 0.8 Mach with a 0° bank is recommended. If necessary, a 15° maximum bank angle can be made. At no time during reel-out should the cable tension exceed 75 percent of the breaking tension for the length of cable in transit. (Refer to T.O. 43E-17-1-101 for flight restrictions of the cable.) The towline continues to reel-out at a constant speed until a preset length is reached. This is the out-stop setting. The towline then decelerates at 2.1 feet per second and stops. The target is then at tow length and intercepts may be accomplished.

Mission altitude for towing should be 30,000 - 35,000 feet and should be planned so as not to require the

use of afterburner. An airspeed of 0.8 Mach (280 - 300 KCAS) and an angle of bank of 30° should not be exceeded.

REEL-IN

After intercepts are completed, the reel-in cycle is initiated. The power should be reduced to 80 percent and a 250 KCAS descent maintained to a level off altitude of 15,000 feet. During this descent, the reel-in cycle can be initiated. During reel-in, the 15° bank and 300 KCAS limits should not be exceeded. As the reel-in is initiated, the towline accelerates at 2.1 feet per second to a 3700 - 5000 feet per minute reel-in rate. The 3700 feet per minute should be maintained by increasing airspeed until the target reaches a preset distance behind the tow aircraft, at which time the towline decelerates at 2.1 feet per second and stops 800 feet behind the aircraft.

Note

Cable tension during reel-in should not exceed a tension of 400 pounds less than the mission tension.

RECOVERY

During recovery operations, an altitude of 15,000 feet and an airspeed of 300 KCAS is recommended. A straight-and-level attitude is desired although a 5° bank is allowed. As the TSO initiates the recovery cycle, the launcher comes down and the target is reeled in under manual control at about 800 feet per minute. As the target approaches within 150 feet (confirmed by chase plane), the cable speed must be slowed down to a maximum speed of 150 feet per minute. As target engages the launcher, the launcher retracts and the target is clamped to the reel-launcher.

CAUTION

When target has been shot off, cable recovery is initiated as usual. When cable length reaches 25 feet or when the cable starts whipping and balling (observed by secondary tow plane or chase plane), the cable should be cut immediately.

When the mission involves two tow planes, the secondary tow plane flies in a position so that visual reference of each reel operation is maintained. If the primary tow plane receives verification that the target has been shot off, cable recovery is initiated during a descent to 20,000 feet. Upon reaching the level off altitude, the secondary tow plane assumes a position 500 feet abeam of the primary tow plane and launches its target.

CAUTION

As the primary tow plane is initiating reel-in procedures and the secondary tow plane is launching, care should be taken to avoid crossing cables.

RMU-8/A REEL LAUNCHER

The RMU-8/A reel-launcher (figure 1-128) is housed in a jettisonable, supersonic pod. Ground clearance with target stowed is adequate to clear a tail hook arresting cable with aircraft struts and tires flat. If the launcher is down, however, the launcher will not contact the runway even with normal tire and strut inflation. The weight of the reel-luancher (serviced), exclusive of towline weight, is 850 pounds. Installation of the RMU-8/A does not cause any adverse flight characteristics; however, the AC should expect to encounter the following phenomena:

1. Minor vibration during reeling operation, particularly during reel acceleration and deceleration.
2. High pitched whine (like a siren) during high speed reeling.
3. Torque effect during high speed reeling.

The launcher is down for launch and recovery only, and is up during target tow. The reel contains a nitrogen bottle to actuate the launcher and the pneumatic brakes. It uses the aircraft emergency bus to provide power for stopping the reel and cutting the cable if aircraft power is lost.

Towline Length Sensing Unit

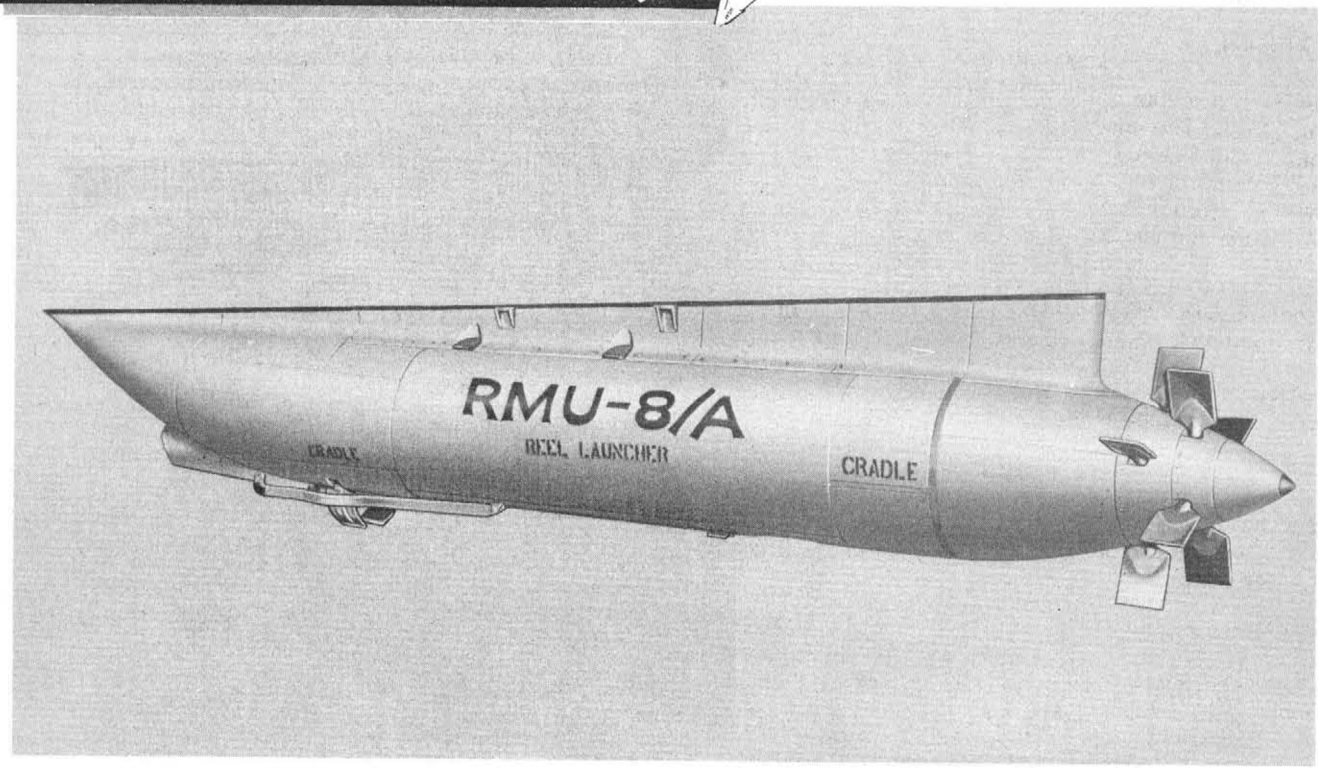
The towline length sensing unit contains pulsing switches used in sensing the amount of towline reeled out, three counter operated limit switches used in automatic sequencing during the launch operations, and a reset mechanism. The switches and switch functions are listed below:

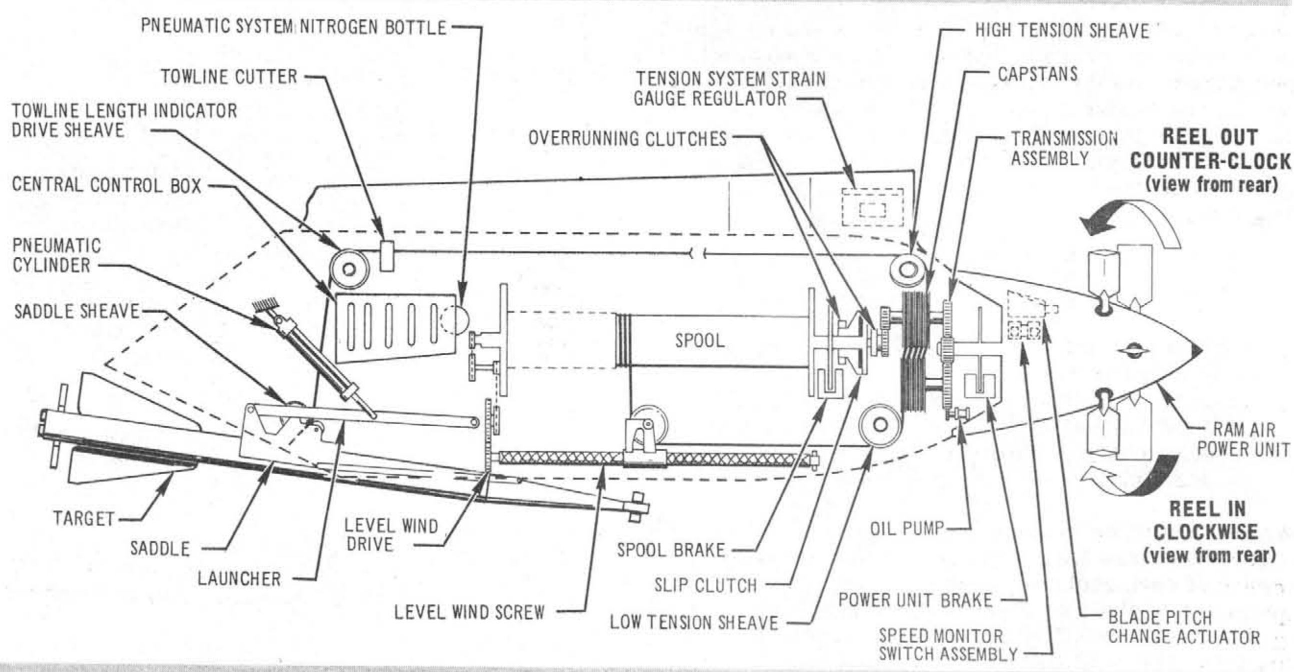
OUT STOP	- The out stop switch is used to set the maximum towline length required (minus stopping distance).
LAUNCH STOP	- The launch stop switch determines the point beyond which high speed reel-out action is permitted.
IN STOP	- The in stop switch determines the point at which deceleration from high speed reel-in occurs, within which high speed reel-in may not be started, and within which manually controlled target recovery may be started.
CABLE IN OUT/OFF	- The cable switch is a three position switch with positions of IN, OUT, and OFF. This switch allows the ground crew to simulate a complete operating cycle. For normal tow target operation, the switch is positioned to OFF.

Blade Pitch Change Actuator

The blade pitch change actuator consists of a reversible d-c motor and a switch package containing

RMU-8/A REEL LAUNCHER





DRAG INDEX 6.4
LENGTH . . . . 160 inches
DIAMETER. . . . . 20 inches
WEIGHT with tow cable and target . . . . approx. 1800 pounds
(Add 51 pounds for the Aero 27A Ejector Bomb Rack.)

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Figure 1-128 (Sheet 1 of 2)

RMU-8/A REEL LAUNCHER

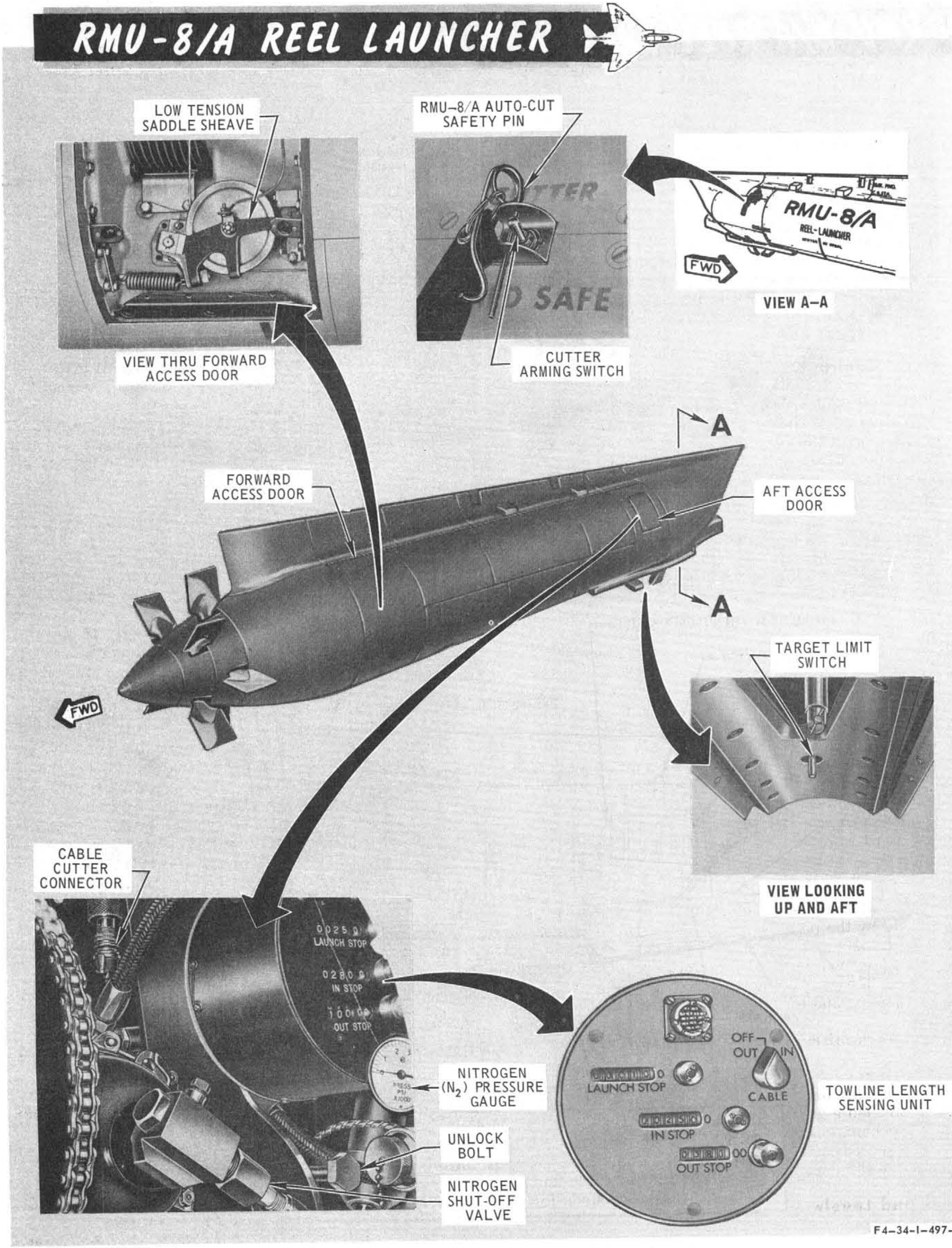


Figure 1-128 (Sheet 2 of 2)

six limit switches. The d-c motor, through a gear train, rotates the power unit blades clockwise during recovery and counterclockwise during launching. The six limit switches are cam operated and determine the number of degrees rotation the blades turn and the direction of the turn.

Speed Monitor Switch Assembly

The speed monitor switch assembly consists of four switches. The operation of each switch is governed by the power unit speed. The switches are set to operate at 8600 to 9400 rpm (normal governing band), at 9900 rpm (ten percent overspeed), and at 10,800 rpm (twenty percent overspeed). The 8600 and 9400 rpm switches perform target reel-out/reel-in speed monitoring functions. The 9900 and 10,800 rpm switches are for emergency control.

Central Control Box

The central control box contains function control relays and an acceleration monitor. The relays are used to control the overall operation of the RMU-8/A. The acceleration monitor is used to automatically control change-rate of the towline speed during the operating cycle.

Power Unit

The power unit consists of eight reversible-pitch blades, each of which attaches to a central hub. The reversible-pitch blades are arranged in two rows of four blades each. The blade angle is controlled through the blade pitch change actuator which is mechanically coupled to the reversible-pitch blades and drives the blades on their individual axis. The power unit is driven by the wind force created by the forward speed of the aircraft. The unit rotates counterclockwise (as viewed from the rear) during reel-out and functions as a brake against the trailing towline and target. The power unit rotates clockwise (as viewed from the rear) during reel-in and functions as a turbine to furnish drive power to the transmission and spool during the recovery operation.

Transmission Assembly

The transmission assembly couples the driving power developed by the power unit through a gear train assembly to the capstan and through a slip-clutch mechanism to the towline spool. The transmission assembly houses the gear train, clutches, oil pump, scavenger oil-pump, and the oil dip stick.

Clutch Mechanism

The clutch mechanism consists of two, over-running, sprag-type clutches and a constant torque slip-clutch driven through a gear train. The arrangement of the clutch mechanism maintains towline tension between the capstan and the towline spool to prevent towline slippage on the capstans.

Spool and Levelwind

The spool and levelwind provides storage of the towline which is reeled-out or reeled-in. For convenience in rewinding, the spool is removable. The levelwind is driven by the spool and may be readily disengaged for purposes of synchronization and threading.

Lubrication

The lubrication system is a wet-sump type with automatic reversing, rotary, internal gear pumps located in the transmission assembly. Positive lubrication is furnished to the main drive gear mesh, capstan bearing, clutch assembly, and power unit. A separate pump scavenges the power unit and discharges the oil into the transmission assembly. The transmission assembly and clutch mechanism are capable of operating approximately 10 seconds with an interrupted oil supply. During the target launch and recovery operations, all oil is routed to the clutch assembly for cooling. There are also two oil pressure switches, an oil pressure indicator, and a temperature indicator in the system. The oil pressure switches and the oil temperature indicator are safety devices which provide a visual indication of low oil pressure and excessive oil temperature to the operator.

Pneumatic System

The pneumatic system provides the necessary power to extend and retract the launcher and to apply the brakes to the reel-launcher. A storage bottle contains compressed nitrogen at 3000 psi. The pressure is reduced to 300 psi before it is delivered to any of the operating mechanisms of the reel-launcher. This supply of nitrogen permits approximately four complete operating cycles. When the storage bottle pressure drops below 700 psi, a light in the control panel gives a low air indication. The latch that holds the launcher in the retracted position is also operated by nitrogen pressure. This latch is in series with the actuating cylinder that forces the launcher down. This is to assure that the latch is opened before the launcher boom is extended. The pneumatic system is designed so that towline tension is maintained at all times during launcher extension and retraction and so that the brakes are applied gradually to prevent snapping of the towline. During an emergency the brakes are applied instantly.

Launcher

A pneumatically operated target launcher is provided to launch and retrieve the target through the region of disturbed air flow around the RMU-8/A and the airplane. The launcher also acts as a shock absorber upon initial target contact during recovery. The launcher contains two mechanical clamps which hold the target when the launcher is fully retracted. These automatically open as the launcher is lowered.

Towline Cutter

An explosive cartridge operated towline cutter is mounted on the launcher support structure and provides for cutting the towline under any possible flight operating condition. The cutter is fired manually by actuation of the emergency stop and towline cut switch

RMU-8/A CONTROL PANELS

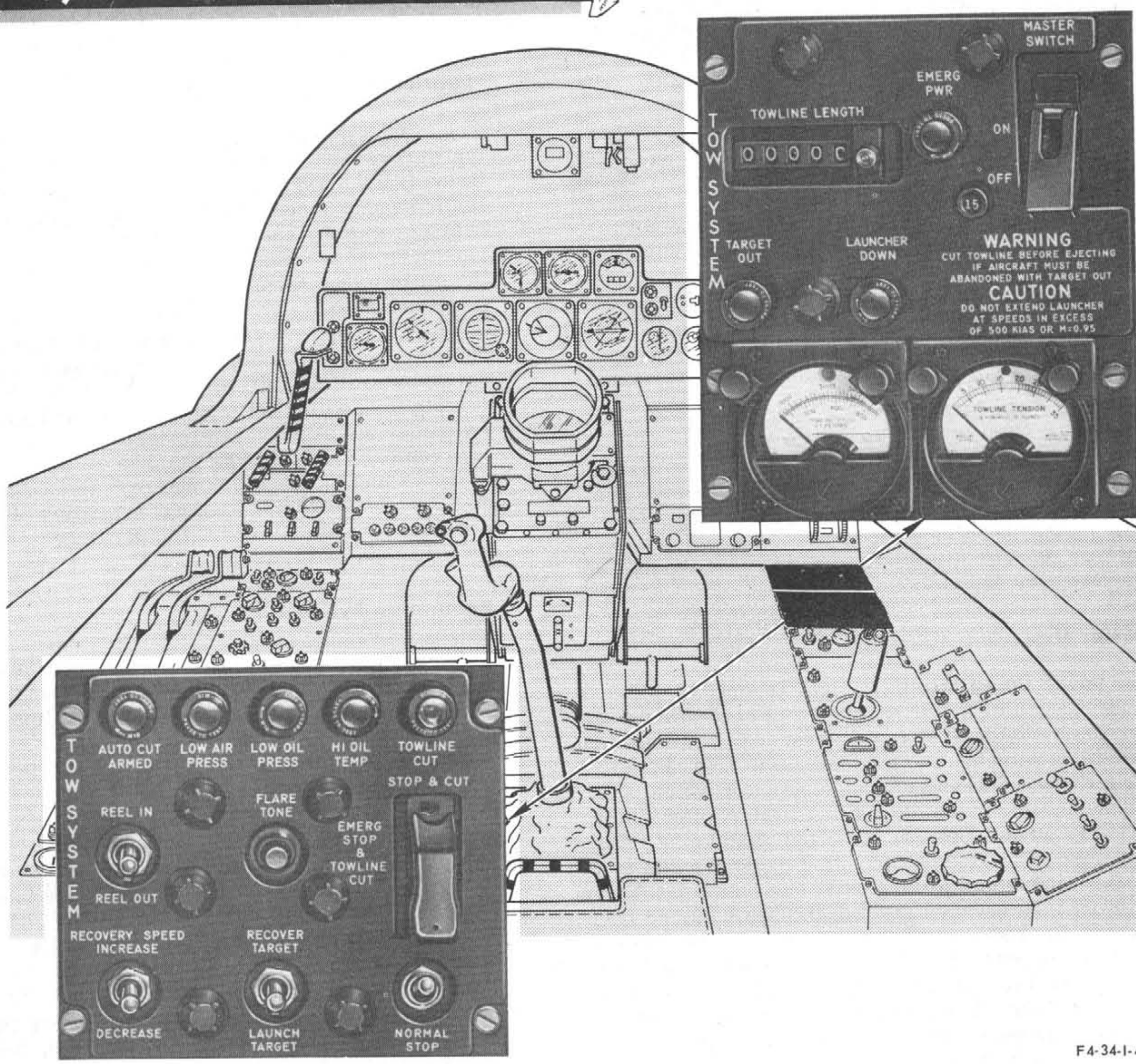


Figure 1-129

and is automatically fired under certain emergency conditions. The conditions under which the towline is cut automatically are: a 20% overspeed (towline reel rate of 6000 ft/min.) during any of the four operating cycles, or target approaching within 200 feet of the aircraft after failure to slow down and stop after passing through the preset in stop distance during the reel-in cycle (towline cutter is actuated by an anti-collision device).

Tension System

A strain gage bridge in the high tension sheave works in conjunction with a regulated power supply to present an indication of towline tension on the towline tension indicator.

Towline Speed Indicating System

A tachometer generator in the reel-launcher provides an indication of towline speed to the operator and a signal indicating the rate of change of speed to the acceleration monitor.

CONTROLS AND INDICATORS

The control panels (figure 1-129) consist of two control boxes which contain all controls and indicators required to operate the system. These control panels are located on the right console in the rear cockpit. The control panels contain the following switches and indicators.

Towline Length Indicator

The towline length indicator indicates the distance (in 10 foot increments) the target is from the reel-launcher assembly.

Emergency Power Light

The EMERG PWR light provides an indication of failure of the primary 28 volt d-c supply.

RMU-8/A Circuit Breaker

The 15 amp circuit breaker on the control panel provides circuit overload protection for the RMU-8/A.

Tow System Master Switch

The tow system master switch applies electrical power to the system. The switch has two positions, ON and OFF, and can be guarded to either position.

Target Out Light

The TARGET OUT light provides an indication that the target has been launched or is loose in the launcher because of lost towline tension.

Launcher Down Light

The LAUNCHER DOWN light provides an indication that the target launcher assembly is in the down position or is not locked.

Towline Speed Indicator

The towline speed indicator provides an indication of the speed the towline is entering or leaving the RMU-8/A. The indicator is calibrated in feet-per-minute and consists of two scales, a lower scale with a range of 0 to 700 and an upper scale with a range of 700 to 6500. The upper scale has a green arc to indicate the normal operating range and a red line at 6000 feet-per-minute to indicate the maximum turbine speed. A green neon light on the dial indicates which speed range is operative. The lower scale is operative with the light off and the upper scale is operative with the light on.

Towline Tension Indicator

The towline tension indicator provides an indication of the tension of the towline. The indication presented is calibrated in hundreds of pounds.

Auto Cut Armed Light

The AUTO CUT ARMED light provides the operator with an indication that the anti-collision device is armed. (Refer to Towline Cutter.)

Low Air Pressure Light

The LOW AIR PRESS light illuminates when the air storage bottle is depleted to an air pressure of 700 psi or lower.

Low Oil Pressure Light

The LOW OIL PRESS light provides an indication of an oil pressure of 2.0 psi or below during the launch or recovery sequence, and of 40 psi or below during the reel-out or reel-in sequence.

Hi Oil Temperature Light

The HI OIL TEMP light provides an indication of high oil temperature should the oil reach a temperature of 220° (104° C).

Towline Cut Light

The TOWLINE CUT light functions in conjunction with the stop and cut sequence. When the stop and cut sequence is activated, the TOWLINE CUT light shows that the action of cutting the towline has been accomplished.

Reel-Out/Reel-In Switch

The reel-out control provides for high speed deployment of the target. When reel-out is initiated with the target stowed, the launch sequence is automatically completed first. The reel-in control provides for high speed recovery of the target to within a short distance from the aircraft. The switch has three positions: REEL-OUT, REEL-IN and a spring-loaded OFF position.

Flare Tone Control Button

The flare tone control button provides a means of firing an IR flare remotely located in the target.

Emergency Stop and Towline Cut Switch

The emergency stop and towline cut switch provides an emergency means of manually stopping and cutting the towline at any time. The switch has two positions: STOP and CUT and a guarded OFF position.

Recovery Speed Switch

The recovery speed switch allows operating personnel to control the speed at which the towline is recovered during the final recovery period. The switch has three positions, INCREASE, DECREASE and a spring-loaded OFF position. Actuating the switch to the INCREASE position incrementally increases the blade angle of the power unit to increase the speed at which the target is recovered. In order to obtain a large increase in recovery speed, the switch must be alternately actuated and released until a maximum recovery speed of approximately 1000 feet per minute is achieved. Actuating the switch to the DECREASE position will continuously drive the power unit blades toward the feather position and target recovery speed will decrease. For small decreases in target recovery speed, the switch must be actuated to the DECREASE position intermittently.

CAUTION

If a recovery is made immediately following launch (the blades will be at the reel-out feather angle) the recovery speed switch must first be actuated to the INCREASE position, followed by actuation of the switch to the DECREASE position to drive the blades to the reel-in feather angle.

Launch Recover Switch

The launch/recover switch provides for the slow speed launching of the target to a short distance behind the aircraft during the launch cycle and provides for manual control of target recovery during the recovery cycle. The launcher is extended during the launch and recovery cycles. The switch has three positions, LAUNCH TARGET, RECOVER TARGET, and a spring-loaded OFF position. Momentary actuation of the switch to the LAUNCH TARGET or RECOVER TARGET position is sufficient to initiate the respective cycles.

Normal Stop Switch

The normal stop switch allows any operation that is in progress to be halted. The switch has two positions, NORMAL STOP and a spring-loaded OFF position.

Control Circuit Sequencing

The normal stop and the emergency stop and towline cut functions can be initiated at all times. The normal stop function must be initiated to interrupt any cycle before initiating a new cycle. The following table illustrates cycles that can be initiated after the completion of a manual or automatic normal stop at various towline lengths relative to the towline length limit switch.

Target Position	Functions Possible
Target Stowed	Launch, Reel-Out
Target between stowed position and in-stop (2500 ft)	Reel-Out, Recover
Target between in-stop (2500 ft) and out-stop	Reel-Out, Reel-In
Past out-stop	Reel-In

SYSTEM ELECTRICAL POWER

Primary dc electrical power for operation of the tow system is provided by the aircraft 28 volt dc bus. Emergency dc power is provided for by the aircraft battery bus in case the primary dc power is lost. During operation with emergency power, all normal functioning of the system is automatically stopped and all control switches are inoperative except the emergency stop and towline cut switch. The system will resume normal operation when normal aircraft power is returned to the line and the master switch is cycled to OFF and back ON. Ac power is provided by one of the 115 volt single phase 400 cycle ac aircraft buses. The ac power is used by the acceleration monitor. The electrical system is protected by three circuit breakers: two 28 volt dc circuit breakers (rated for 20 and 10 amperes) and a 115 volt ac circuit breaker (rated for 5 amperes).

MODIFIED A/A 37U-15 TOW TARGET SYSTEM

Note

Modification of the A/A 37U-15 tow target system provides a better target/runway clearance during takeoff.

The A/A 37U-15 tow target system (figure 1-130) consists of a tow reel pod, a tow reel, a boom and launcher for installing the TDU-10/B or the modified K-11 targets, and facilities for incorporating a parachute recovery system for the target. The target system is carried by a MAU-12B/A pylon and tow target adapter on the left outboard wing station. The tow system has the following functions: target launch, cable reel-out, tow, and cable cut. Normal aircraft conventional weapon controls are used for these functions.

BOOM AND LAUNCHER

The boom and launcher, attached to the side of the adapter, provides mounting facilities for the tow target. The boom and launcher holds the target until launch. A nose guide channel holds the nose of the target and keeps the target stable during flight.

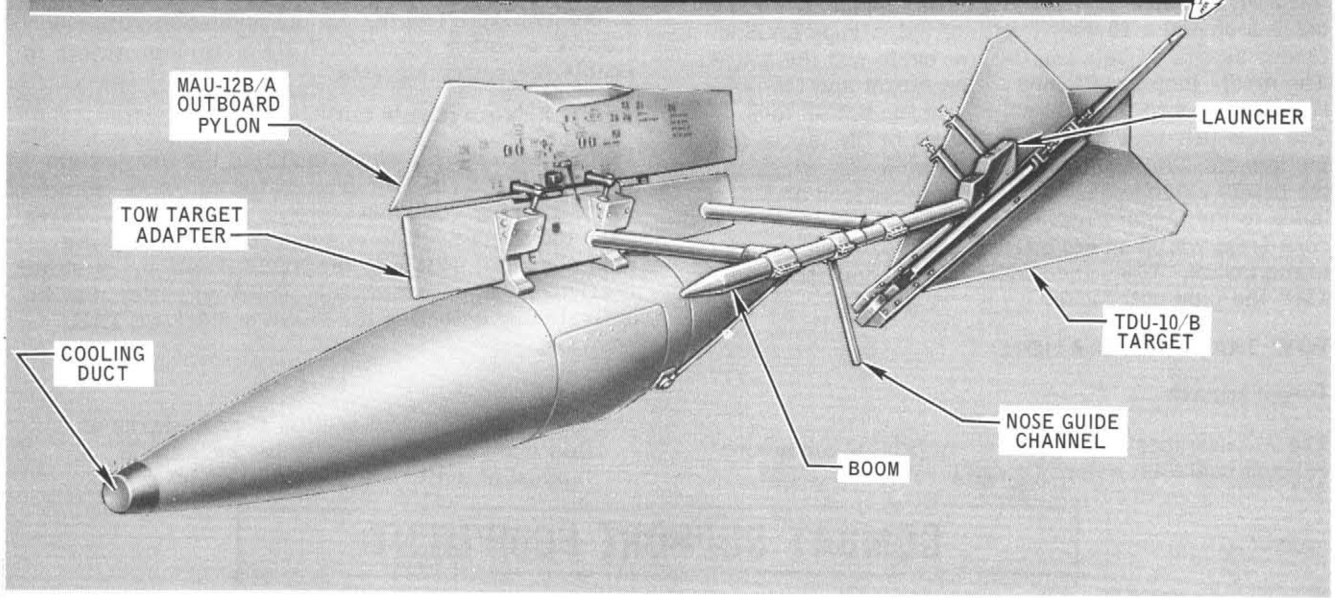
PARACHUTE RECOVERY SYSTEM

A parachute recovery system may be used to recover the tow target. The parachute and canister is attached to the aft end of the pod by cloth tape. The cable is attached to the parachute canister which, in turn, is attached to a 15-foot length of nylon rope. The rope is attached to a bridle loop cable on the tow target. When cut, the falling cable drags behind the target causing the parachute canister to tumble 180°. The canister reversal allows the wind pressure to move aerodynamically operated levers which release the canister lid. The lid acts as a drogue and deploys the recovery parachute. Flight tests have been conducted without the parachute, in which case, the target cannot be recovered after launch.

TOW REEL

The tow reel, mounted in the center section of the tow reel pod, is a one-way reel capable of carrying approximately 2300 feet of 11/64 inch cable or 5000 feet of 1/8 inch cable. Cable reel-out speed is controlled by a self-energized inertial brake acting on the one-way wheel drum. The brake is operated by a centrifugal force built up in fly weights on the drum. A duct admits ram air through the nose of the pod to cool the tow reel braking unit.

MODIFIED A/A 37U-15 TOW TARGET SYSTEM



TOW TARGET SYSTEM (COMPLETE):	
DRAG NUMBER	(To be supplied)
WEIGHT (Complete system with 1500 feet of 3/16 inch cable)	988 Pounds
ADAPTER (With boom and launcher attached):	
DRAG NUMBER	(To be supplied)
WEIGHT	311 Pounds
LENGTH (Boom and Launcher)	11 Feet

TOW TARGET POD:	
DRAG NUMBER	(To be supplied)
WEIGHT (With 1500 feet of 3/16 inch cable)	482 Pounds
WEIGHT OF CABLE	97.5 Pounds
LENGTH	13.4 Feet
DIAMETER	18 Inches
SUSPENSION LUG DISTANCE	14 Inches

TDU-10 B TOW TARGET:	
WEIGHT	195 Pounds
LENGTH	16 Feet
WING SPAN	5 Feet
FLIGHT LIMIT	(Refer to Flight Limit in T.O. 1F-4C-1)

F4-34-1-484

Figure 1-130

TDU-10/B TARGET

The TDU-10/B target consists of four fins or wings mounted together to form a dart like shape. A bridle cable loop and a 15-foot length of nylon rope form a leader assembly between the tow cable and the target. The bridle loop is attached to the target and the nylon rope attaches to the reel cable and the bridle loop. The rope provides dampening effect to the target during launch. While the target is stowed, the slack in the bridle cable and nylon rope is lockwired and taped to the target fins. This prevents the cable and rope from whipping during flight and causing damage to the target. When the target is launched, the lockwire and tape pull loose.

TOW TARGET OPERATION

Target Launch

The AC launches the target by energizing the normal release controls: select DIRECT, select BOMBS, select the target station, and select master arm. The target is launched by depressing the bomb release button once; cable reel-out follows at governed speed to the available length. As the bomb button is released, a rotary solenoid shifts a transfer switch to enable the cutter circuits.

Target Release (Cable Cut)

Before revision K, which modified the tow system jumper bundle, the squib operated cutter is energized by depressing the bomb button a second time. After revision K, the cutter is activated by placing the arm nose/tail switch to the NOSE position. In either configuration, an emergency (backup) cutter may be activated by selecting the NOSE & TAIL or TAIL position.

Note

The Checklist, and section II procedures of this manual consider only the revision K method of activating the cable cutter.

COMBAT SUPPORT EQUIPMENT

KB-18A STRIKE CAMERA SYSTEM

The F-4C/D/E aircraft can be equipped with the KB-18A strike camera system after incorporation of the following time compliance directives.

F-4C - T.O. 1F-4C-603
F-4D - T.O. 1F-4D-525
F-4E - T.O. 1F-4E-516

The camera pod is installed in the left forward missile well for F-4C aircraft modified by Mod 1778B. T.O. 1F-4C-603 installs provisions for the KB-18 system in remaining aircraft in the right forward missile well. F-4D/E aircraft are equipped for the KB-18A camera pod in the right forward fuselage missile well. The panoramic camera mounted in the pod provides continuous film documentation of the strike area throughout an air-to-ground armament delivery. Camera operation is initiated by pressing the trigger switch in the front cockpit or by pressing the bomb button in either the front or rear cockpit. An overrun dial on the camera control in the camera pod is set before flight to provide extended camera operation after the trigger switch or bomb button is released. The AC may operate the camera without expending munitions by pressing the extra picture button on the KB-18A camera control panel in the front cockpit (figure 1-131). The KB-18A strike camera system includes the following components:

a. Camera and film magazine.
b. Camera control.
c. Temperature/defogging control system.
d. Remote camera power switch in the pod. (The switch must be ON before flight.)
e. KB-18A camera control panel (front cockpit).

CAMERA AND FILM MAGAZINE

The camera has a 3-inch focal length (75mm), f/2.8 lens with automatic exposure control. Continuous panoramic coverage is accomplished in the following manner. A double dove prism is rotated in front of the lens while the film is advanced across a narrow slit at the focal plane of the camera. The film advance is synchronized with prism rotation, projecting the panoramic image on the film as the prism scans a 180° front to rear, by 40° side to side area. The automatic exposure control senses variations in scene illumination and initiates compensatory aperature adjustments, thereby enhancing dawn-to-dusk photography. The film magazine is attached to the camera body and accommodates 250 feet of 70mm aerial roll film. The film is exposed at a pre-set rate of 1, 2, or 4 frames per second and produces photographs with a format size of 2.25 by 9.4 inches.

CAMERA CONTROL

The camera control in the pod contains switches and electronic components necessary to ground test the camera temperature control system and pre-select camera operation. The adjustable controls on the face panel include the cycle rate switch, overrun dial, and automatic exposure index (AEI) switch. These ground adjustments are established by mission requirements.

Overrun Dial

The overrun dial is set before flight and determines the amount of time the camera operates after the trigger switch or the bomb button is released. The dial is calibrated in 2-second increments from 0 to 20 seconds and includes an additional 32-second dial setting. The extra picture switch does not energize the camera overrun circuit.

Cycle Rate Switch

The cycle rate switch is a three-position film speed control. This switch enables selection of 1, 2, or 4 picture frames per second during camera operation. The cycle rate switch is set in accordance with the planned altitude/airspeed combination.

Figure 1-131

AEI Switch

The automatic exposure index switch enables selection of four values of film exposure sensitivity. These exposure index values are 40, 64, 80, or 100.

KB-18A Extra Picture Switch

The KB-18A camera control panel figure 1-131 is mounted in the front cockpit near the flap control panel. The panel contains the extra picture button which allows the AC to operate the camera without expending munitions. The camera operates at the rate selected on the cycle rate switch when the extra picture button is pressed.

Note

Before flight, the overrun dial, cycle rate switch, AEI switch, and the power switch in the camera pod must be properly set.

The camera operates automatically during air-to-ground armament delivery. Furthermore, camera operation continues until overrun time (set on the overrun dial) terminates.

COMBAT DOCUMENTATION MOTION PICTURE CAMERA SYSTEM

The combat documentation motion picture camera system is provided on selected F-4C/D/E aircraft. The camera system consists of two 16 mm motion picture cameras; the N-9 forward looking and the DBM-4 or KB-21 aft looking cameras. The cameras are mounted in the aircraft as follows:

a. (F-4C) Both the N-9 and DBM-4 are initially installed in the chin dome. After T.O. 1F-4-820, the N-9 camera is relocated to the recess well area of door 137R.

b. (F-4D after T.O. 1F-4-820, and F-4E-45 and up) The N-9 camera is installed within the recess area of door 137R; the KB-21 is installed within door 137L.

The N-9 forward camera produces motion picture film coverage of gunfire, rocket, and missile impacts. The DBM-4/KB-21 camera is oriented down and aft to document bomb impacts and post strike results of gunfire and rocket attacks. Normal system operation is controlled by actuation of the trigger switch or bomb release button. Operation of the cameras without the expenditure of ordnance is provided by an extra picture button in the forward cockpit (F-4C), or rear cockpit (F-4D/E). These are the only cockpit controls associated with the cameras. Each camera is equipped with a ground adjustable timer to allow additional pictures to be taken after release of the trigger switch or bomb button. The aft looking camera has a delay timer to delay operation by a preset time.

F-4D/E aircraft have a quick release safety pin which precludes camera ground operation. The pin is installed in the outboard side of door 137R and must be removed prior to flight.

N-9 AND DBM-4/KB-21 CAMERAS

The N-9 is a 16 mm motion picture camera which uses standard 16 mm black and white or color film. The camera is equipped with a variable focal length (20-80 mm) lens and operates at camera speeds of 16, 32, or 64 frames per second. The film magazine has a 100-foot capacity with daylight loading spools. The top aft end of the magazine contains a window through which the quantity of unexposed film is indicated.

The DBM-4 and KB-21 are 16 mm motion picture cameras which use standard black and white or color film. The cameras are equipped with a variable focal length (17-68 mm) lens and a continuously variable frame rate capability which is set by controls on the cameras. The film magazine has a capacity of 200 feet.

SYSTEM CONTROLS

A relay panel under door 137R contains the camera timers and other controls used for ground operations. The camera power switch on the relay panel must be ON to allow operation of the cameras. The camera timers (one for each camera) are set to the desired overrun time; i.e., the time desired for the cameras to run after release of the trigger switch or bomb button. A delay timer is provided for the aft looking camera. When the mission involves guns or rockets, it is desirable to start the aft looking camera at a time later than firing time. The delay timer is set at this desired time interval. Momentary actuation of the bomb button or trigger switch activates the delay timer and the overrun timers. The forward looking camera begins running and continues until time-out of the overrun timer. At the completion of the delay

time, the aft looking camera starts running and continues for the duration of the aft looking camera overrun timer setting. If the bomb button is held pressed for a period of time, the delay timer begins its countdown when the button is first pressed but the overrun timers begin counting down when the bomb button is released. A second actuation of the bomb button before the overrun timers have timed out (cameras still running) recycles the overrun timers so that the overrun time begins when the bomb button is released the second time. The aft looking camera delay timer is activated on the first actuation of the bomb button and is not affected by a second actuation unless the overrun sequence is completed. Each timer has a setting range of approximately 1 to 30 seconds.

Note

Any actuation of the bomb button when the landing gear is up causes the cameras to operate regardless of other cockpit switch configurations. The trigger switch, however, will not operate the cameras unless the missile/gun arm switches are armed.

Extra Picture Button

The extra picture button is above the right console in the forward cockpit (F-4C), and rear cockpit (F-4D/E). The button operates the cameras any time without the delivery of armament. Camera operation through the extra picture button is the same as operation through the bomb button and trigger switch. The overrun and delay timers function the same as explained previously.

RADAR TRANSPONDER SST-181X

The radar X band transponder is installed in F-4C aircraft after T.O. 1F-4C-577, in F-4D aircraft thru block 33 with T.O. 1F-4D-510, and in F-4E aircraft after T.O. 1F-4E-510. The transponder is used to extend the range tracking capabilities of certain ground-based tracking radar sets and to increase the adverse weather navigation capabilities in underdeveloped areas. These are transportable navigation, or special purpose X-band radars, which may be moved to forward areas and used to vector the aircraft to any specific area of interest. The ground-based radar transmitter emits X-band radar signals which interrogate the SST-181X radar beacon in the aircraft. The SST-181X, in turn, transmits a single or double pulse reply (in the same frequency band) to the interrogating radar set. Therefore, the radar site is actually receiving a transmitted signal which is considerably stronger than a radar echo. This improves target acquisition capabilities at radar maximum ranges, especially in adverse environmental conditions.

PULSE SELECTOR SWITCH

The pulse selector switch is on the rear cockpit right console. The switch has positions of OFF (center), SINGLE, and DOUBLE. If the pilot selects SINGLE, a single reply pulse is generated for each interrogation. In DOUBLE, the system generates two reply pulses at a predetermined spacing. The operating mode (SINGLE or DOUBLE) may be determined during mission briefing or by direct voice communication with the radar site.

RADAR TRANSPONDER OPERATION

There are no indicators that show system operation; the pilot simply energizes the system by selecting the single or double operating mode. Vectoring information is obtained by voice communications between the aircrew and the ground controller.

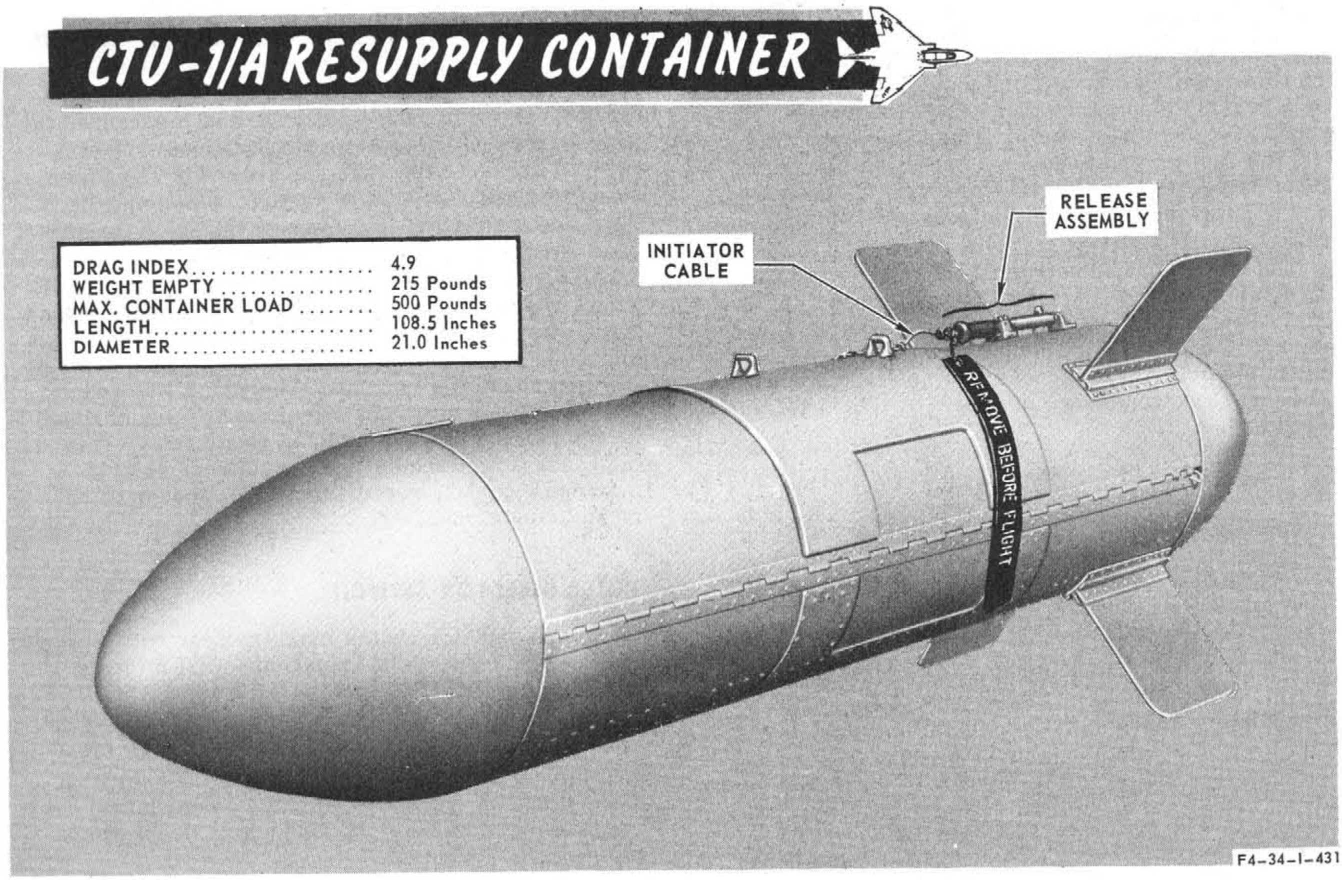


Figure 1-132

CTU-1/A RESUPPLY CONTAINER

The CTU-1/A is a parachute retarded container used to deliver combat supplies to ground forces (figure 1-132). The container may be loaded with any equipment up to a maximum weight of 500 lbs., provided the equipment can be loaded to maintain the container C.G. within allowable limits.

Note

> The parachute system limits the delivery speed to 450 KCAS maximum, and the delivery altitude to 300 feet AGL minimum.

The CTU-1/A consists of three basic assemblies: the fin stabilized container, an XM5 cartridge-actuated parachute release assembly, and the parachute assembly. At release, the initiator cable attached to the rack causes detonation of the cartridge-actuated release assembly. After a 0.3 second delay, the release assembly ejects the tail cone and deploys the pilot parachute. The pilot parachute in turn deploys the main parachute to a reefed diameter of 36 inches. Explosive cutters then part a reefing line and initiate blossoming to full diameter. Container descent is therefore controlled to an impact velocity of approximately 30 feet per second and at a nearly vertical impact angle.

CTU-1/A CENTER OF GRAVITY

At release, the aerodynamic stability of the loaded container is specifically dependent on maintaining the loaded container center of gravity within specified limits. Improper C.G. control can result in violently unstable separation characteristics. The appropriate authority must therefore verify that the weight and C.G. location are within allowable limits as a function of the planned payload and release airspeed. A plot is provided in section IV, Supplementary Data, so that the aircrew may establish the C.G. required for a stable separation. CTU-1/A level delivery bombing tables are provided in T.O. 1F-4C-34-1-2.

SECTION II NORMAL AIRCREW PROCEDURES

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INTRODUCTION

In accordance with AFR 60-9, the aircrew is required to use this checklist when operating this aircraft with non-nuclear weapons. However, this checklist contains an exterior inspection of suspension equipment and non-nuclear weapons (part 4 of this section) that are considered mission essential which the aircrew IS NOT REQUIRED TO PERFORM since the correct installation and loading of suspension equipment and non-nuclear weapons is the responsibility of certified loading crew members. The exterior checks preceded by a star (★) are considered SAFETY OF FLIGHT ITEMS which should be checked by an aircrew member if time permits. The mission essential exterior check may be performed if desired.

Note

During Delayed Flight or Alert, certain safety pins may be removed, electrical cable plugs may be connected, and missile motor switches armed as directed by Major Command or as directed by Local Commander during combat conditions. Checklist items assigned to be performed in the Arming Area, may be performed in any Designated area when the aircraft is on Delayed Flight or Alert status.

The procedures contained in this section are reproduced in checklist form and presented verbatim in T.O. 1F-4C-34-1-1CL-1. Warnings, Cautions, Notes, and Amplifications have not been included in the checklist. When this section is changed or revised, the checklist will be changed concurrently.

This section is divided into four parts according to aircraft effectivity:

Part 1. F-4C Aircraft
Part 2. F-4D Aircraft
Part 3. F-4E Aircraft
Part 4. F-4C/D/E Aircraft

And each part is divided into the following categories:

a. (AC) Aircraft Commander System Checks, forward cockpit.
b. (P) Pilot or WSO (Weapon Systems Officer) System Checks, rear cockpit. The term (P) is used throughout this section.
c. Combat Weapons
d. Training Equipment

Each category is further divided according to weapon, system, or equipment and is complete from preflight through inflight. The format of this section follows the format of the checklist which permits the aircrew to reduce the size of his checklist by first removing all parts that are not applicable to his aircraft, and all checklists that do not apply to his crew duty. To further reduce the size of the checklist, the aircrew may remove all pages that do not apply to the squadron mission. Use the table of contents to assist in determining the pages to be removed and filed for possible future use, and the pages that will comprise the usable checklist. Some pages in the checklist are intentionally left blank to facilitate the removal of a complete system or weapon category. Preflight checks are illustrated in part 4 of this section.

PART 1 NORMAL AIRCREW PROCEDURES F-4C

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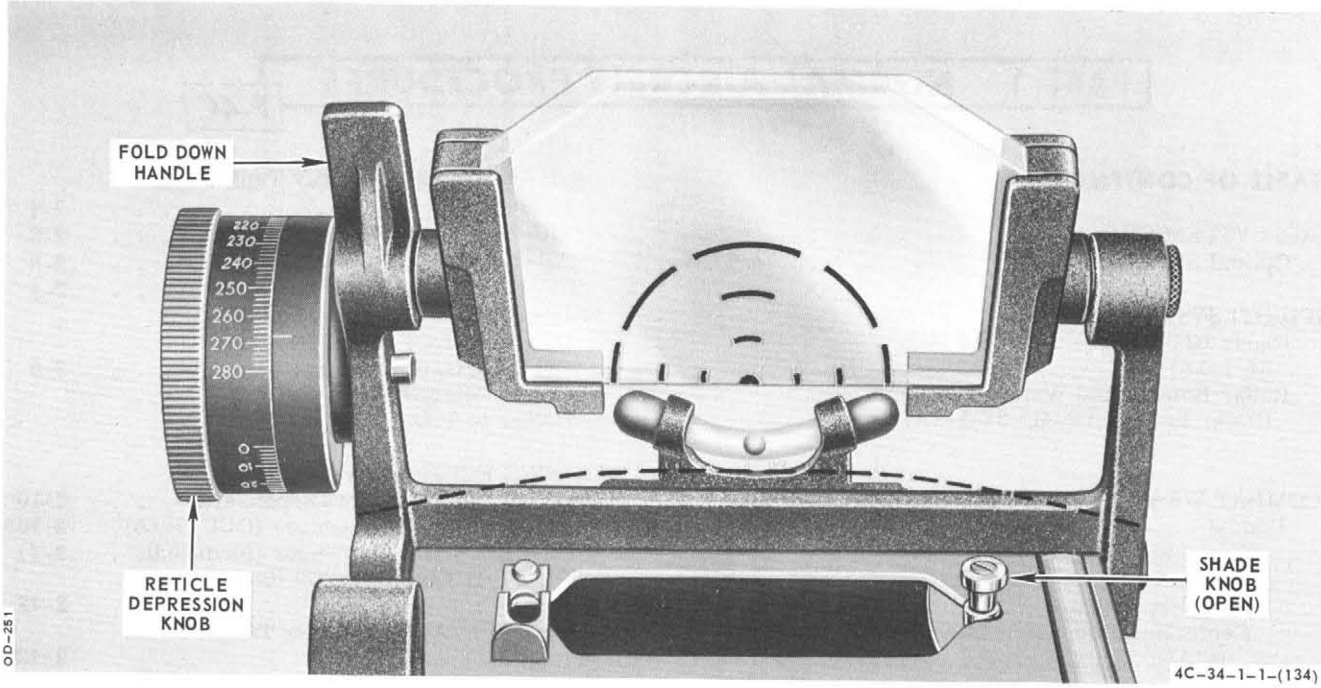


Figure 2-1

OPTICAL SIGHT CHECK (F-4C)

1. Optical shade knob - OPEN
2. Reticle illumination - CHECK
   a. Rotate illumination knob left/right and check both filaments; use left (counterclockwise) position during continuous operation.
   b. Observe reticle image clearly focused.
   c. Check 20, 40, and 60 mil references at 3, 6, 9, and 12 o'clock positions.
3. Observe date and depression calibration placard. (On inside of reticle depression knob if available.)
4. Align LOS along top of sight head (below ball and race) and tangent to highest point of radome.
5. Rotate depression knob until 1/2 of pipper is visible on combining glass (figure 2-1).
   a. Depression knob should read within ± 2 mils of step 3 placard. (With placard not available depression knob should read approximately 268 ± 2 mils.)
6. Reticle depression knob - 240 MILS
   a. Pick stationary point in LOS with top of reticle.
   b. Move bottom of reticle to stationary point (60 mils travel); depression knob reads 180 mils.
   c. Repeat steps a and b until sight zeros; depression knob reads ± 2 mils.
7. Reticle illumination - OFF
8. Optical shade knob - CLOSED
   If further use of the sight is not anticipated, close the shade to prevent sun light from entering optical system.

CAUTION

The sight is folded down by using the handle (figure 2-1). Do not touch the sight reflector glass.

BOMBS (F-4C)

PREFLIGHT

Refer to part 4, figures 2-20A and 2-21.

INFLIGHT

Note

After T.O. 1F-4-750 (BRU-5/A rack), the following release procedures may be used to release the M118 or MK 84 GP bomb from the CL station. On unmodified aircraft the DCU-94/A procedures may be used.

DIVE AND LEVEL BOMBING

1. Reticle depression knob - SET
2. Weapon selector knob - BOMBS
3. Arm nose tail switch - SET
4. Intrvl switch - SET (if applicable)
5. Station selector knob - LOADED STATION
6. Master arm switch - ARM
7. Bomb button - DEPRESS

EMERGENCY BOMB RELEASE

1. Weapon selector knob - BOMB/RIPPLE
2. Repeat above steps (3) thru (7), hold bomb button depressed 4 seconds.

If all bombs do not release:

3. Weapon selector knob - RKTS & DISP
4. Weapon selector knob - BOMBS/RIPPLE
5. Bomb button - DEPRESS (hold 4 seconds)

LOFT BOMBING

Before Bomb Run

1. (P) Low angle knob - SET
2. (P) Pullup timer - SET
3. (P) Release timer - SET ZERO
4. Bomb mode selector knob - LOFT
5. Multiple weapons control panel - SET
   a. Weapon selector knob - BOMBS/RIPPLE
   b. Arm nose tail switch - NOSE & TAIL
   c. Interval switch - SET
   d. Station selector switch - SET
   e. Master arm switch - SAFE

At IP

1. Bomb button - DEPRESS AND HOLD
   The bomb button must be energized until the final bomb is released.
2. At pullup point, throttles - FULL MIL POWER

At Release Point

1. Pullup light - ON
2. Master arm switch - ARM

Loft Bomb Delivery

Approach the IP at the preplanned altitude and true airspeed. When over the IP, depress and hold the bomb button energized until the final bomb is released. When the bomb button is depressed, the pullup light illuminates, the pullup timer starts, and the ADI pointers center. One second prior to completion of the pullup timer, the warning tone (motor timer) is audible in the headset. This is the signal to the AC to select full military power and begin rotation into the pullup maneuver by flying the ADI pointers. Upon completion of the pullup timer, the pullup light goes out and the horizontal pointer begins programming a 4-G pullup. When the aircraft attitude is at the preselected release angle, the pullup light and the break light will illuminate. This is the signal to the AC to immediately position the master arm switch to ARM. Placing the master arm switch to ARM initiates bomb release. After the final bomb is released, the bomb button is released and the AC initiates a wingover escape maneuver to achieve a 120° turn while diving toward minimum escape altitude. When the bomb button is released, the pullup light and the break light goes out and the horizontal pointer moves out of view.

After Escape Maneuver

1. Master arm switch - SAFE
2. Weapon selector knob - OFF
3. Bomb mode selector knob - OFF
   Placing the bomb mode selector switch OFF, removes power from the bombing timers.

CENTERLINE BOMB RELEASE (DCU-94/A)

Before Bomb Run

1. Bomb mode selector knob - DIRECT
2. Optical sight - SET (if required)
3. (P) Nuclear store consent switch - REL ARM
4. DCU-94/A CL stations select switch - FORWARD
5. Arm nose tail switch - ARM

Bomb Run

1. DCU-94/A master release lock switch - FORWARD
   a. CL Unlocked light - ON
2. Master arm switch - ARM
   The master arm switch applies power to the arm nose tail switch
3. Delivery maneuver - EXECUTE
   If the DIRECT delivery mode is selected, the bomb is released when the bomb button is depressed.

Note

If the bomb does not release, recheck switch positions, select the DIRECT release mode and depress bomb button, or energize the nuclear store jettison control.

POST STRIKE

Before Landing

1. Master arm switch - SAFE
2. Station selector knob - OFF
3. All DCU-94/A station selector switches (5) - AFT
4. Missile arm switch - SAFE
5. Missile power switch - OFF
6. Missile jett knob - OFF

Armament Area (De-arming)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

ROCKETS (F-4C)

PREFLIGHT

Refer to part 4, figure 2-22.

INFLIGHT

ROCKET FIRING

1. Reticle depression - SET
2. Weapon selector knob - RKTS & DISP
3. Station selector knob - LOADED STATION
4. Master arm switch - ARM
5. Bomb button - DEPRESS

LAUNCHER RELEASE

1. Weapon selector knob - BOMBS/RIPPLE
2. Repeat above steps 3, 4, and 5, hold bomb button depressed 4 seconds.

If all launchers do not release:

3. Weapon selector knob - RKTS & DISP
4. Weapon selector knob - BOMBS/RIPPLE
5. Bomb button - DEPRESS (hold 4 seconds)

BEFORE LANDING

1. Master arm switch - SAFE
2. Station selector knob - OFF
3. All DCU-94/A station selector switches (5) - AFT
4. Missile arm switch - SAFE
5. Missile power switch - OFF
6. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

CBU AND FLARE DISPENSERS (F-4C)

PREFLIGHT

Refer to part 4, figure 2-23.

INFLIGHT

DISPENSING

1. Reticle depression knob - SET
2. Weapon selector knob - RKTS & DISP
   a. (SUU-13, -38, -42) Weapon selector knob - RKTS & DISP/SINGLE
3. (SUU-7) Intrvl - SET (if required)
4. Station selector knob - LOADED STATIONS
5. Master arm switches - ARM
6. Bomb button - DEPRESS (and hold if required)
7. (SUU-7) CBU lights - MONITOR
   a. Blinking light - Tubes Remaining
   b. CBU light ON steady - All tubes have received a firing pulse.

Note

The CBU lights monitor the SUU-7 dispenser only.

DISPENSER RELEASE

1. Weapon selector knob - BOMBS/RIPPLE
2. Repeat above steps (4) thru (7), hold bomb button depressed 4 seconds.

If all dispensers do not release:

3. Weapon selector knob - RKTS & DISP
4. Weapon selector knob - BOMBS/RIPPLE
5. Bomb button - DEPRESS (hold 4 seconds)

BEFORE LANDING

1. Master arm switch - SAFE
2. Station selector knob - OFF
3. All DCU-94/A station selector switches (5) - AFT
4. Missile arm switch - SAFE
5. Missile power switch - OFF
6. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

A/B45Y-1, -2, -4 SPRAY TANK DISPENSERS (F-4C)

PREFLIGHT

Refer to part 4, figure 2-24.

INFLIGHT

DISPENSING (A/B 45Y-1, -2, -4)

1. Weapon selector knob - RKTS & DISP

Note

The Weapon selector knob is positioned RKTS & DISP/PAIRS to supply a release signal to both outboard stations simultaneously. If one tank is carried, it should be carried on the left outboard station. Also, if it is desired to operate only one tank (left side), the weapon select knob must be positioned to RKTS & DISP/SINGLE and the RESET switch must be momentarily positioned to RESET before the bomb release button is depressed again to start dissemination. To disseminate from the right wing station after the corresponding left tank has been emptied, the weapon selector knob may be positioned to RKTS & DISP/ PAIRS.

2. Station selector knob - LOADED STATIONS
3. Arm nose tail switch - NOSE & TAIL
4. Master arm switch - ARM

Note

Placing the master arm switch to ARM arms the A/B 45Y-1 tank causing an explosive squib to discharge, thereby pressurizing the bladder of liquid.

WARNING

Once the A/B 45Y-1 is armed, it cannot be de-armed and therefore must not be brought back to base.

Note

- On the A/B 45Y-2 dry agent spray tank, energizing the master arm switch causes the agent container to be pressurized by ram air for proper dissemination. The Y-2 tank can be de-armed by positioning the master arm switch to SAFE.
- On the A/B 45Y-4 dry agent spray tank, energizing the master arm switch arms the tank. The Y-4 tank can be de-armed by positioning the master arm switch to SAFE.

5. Bomb button - DEPRESSED
6. CBU light - MONITOR
   a. Blinking light - spray remaining
   b. CBU light on steady - no spray remaining

DISPENSER RELEASE

1. Wing tank jett switch - JETT

BEFORE LANDING

1. Master arm switch - SAFE
2. Station selector knob - OFF
3. All DCU-94/A station selector switches (5) - AFT
4. Missile arm switch - SAFE
5. Missile power switch - OFF
6. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

TMU-28/B SPRAY TANK (F-4C)

PREFLIGHT

Refer to part 4, figure 2-24.

INFLIGHT

1. Weapon selector knob - NOT IN RKTS & DISP
2. Arm nose tail switch - SAFE
3. Master arm switch - SAFE

DISPENSING

1. Station selector knob - OUTBD WING
2. Master arm switch - ARM
3. To extend boom, weapon selector knob - RKTS & DISP/SINGLE
   a. While boom is extending, CBU light(s) - ON STEADY
   b. Boom fully extended, CBU light(s) - BLINKING
4. To begin dispensing, bomb button - DEPRESS AND HOLD (8 sec)
5. To stop dispensing, bomb button - RELEASE
6. Weapon selector knob - NOT IN RKTS & DISP
7. To retract boom, nose tail arm switch - NOSE & TAIL
   a. CBU light(s) will continue to blink after boom is retracted.

Note

The CBU light(s) will continue to blink until power is removed from the aircraft, except when the station selector knob is in OFF. When the station selector knob is positioned to OUTBD WING, the CBU lights will begin blinking again.

8. Station selector knob - OFF
   a. CBU lights - OFF

DISPENSER RELEASE

1. Wing tank jett switch - JETT

BEFORE LANDING

1. Master arm switch - SAFE
2. Station selector knob - OFF
3. All DCU-94/A station selector switches (5) - AFT
4. Missile arm switch - SAFE
5. Missile power switch - OFF
6. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

PAU-7/A SPRAY TANK (F-4C)

PREFLIGHT

Refer to part 4, figure 2-24.

INFLIGHT

1. Weapon selector knob - NOT RKTS & DISP
2. Arm nose tail switch - SAFE
3. Master arm switch - SAFE

DISPENSING

1. Station selector knob - OUTBD WING
2. Weapon selector knob - RKTS & DISP/SINGLE
3. Master arm switch - ARM
4. To extend boom, arm nose tail switch - NOSE & TAIL
5. To dispense, bomb button - DEPRESS AND HOLD
   Tank will dispense with boom up or down.
6. To stop dispensing, bomb button - RELEASE
7. To retract boom, nose tail arm switch - TAIL (90 sec)
8. Station selector knob - OFF (after boom retract)

DISPENSER RELEASE

1. Wing tank jettison switch - JETT

BEFORE LANDING

1. Master arm switch - SAFE
2. Station selector knob - OFF
3. All DCU-94/A station selector switches (5) - AFT
4. Missile arm switch - SAFE
5. Missile power switch - OFF
6. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

SUU-16/A, -23/A GUN POD (F-4C)

PREFLIGHT

Refer to part 4, figure 2-25.

INFLIGHT

STRAFING

1. Reticle depression knob - SET
2. Gun clear switch - NON-CLEAR or AUTO CLEAR
3. Gun station selector switch - READY
4. Master arm switch - ARM, RAT OUT
5. Trigger switch - ACTUATE

FINAL BURST-SAFE GUNS (ROUNDS REMAINING)

1. Gun clear switch - AUTO CLEAR
2. Trigger switch - ACTUATE
3. Master arm switch - SAFE, RAT IN
4. Gun station selector switch - SAFE

BEFORE LANDING

1. Master arm switch - SAFE
2. Station selector knob - OFF
3. All DCU-94/A station selector switches (5) - AFT
4. Missile arm switch - SAFE
5. Missile power switch - OFF
6. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

AGM-12B/C/E MISSILE (F-4C)

PREFLIGHT

Refer to part 4, figure 2-26.

INFLIGHT

TRANSMITTER CHECK

If required, perform a fly-by check as follows:

1. Gam-Aux switch - TEST
   The transmitter timer is energized for 50 ± 10 seconds.
2. Control handle - TRANSMIT COMMANDS

BEFORE MISSILE LAUNCH

1. (AC, P) Oxygen diluter selector -100 PERCENT
2. Weapon selector knob - GAM-83 (AGM-12)
3. Station selector knob - INBD or OUTBD WING
4. Launch pulse - POSITION
   a. Step switch - RESET
      Momentarily select RESET to direct the first fire signal to the selected left wing station.

MISSILE LAUNCH

Left Wing Station

1. Master arm switch - ARM
   The arm position powers the station selector switch and completes the bomb button intervalometer circuit.
2. Bomb button - DEPRESS (2 sec. approx)
   Depress and hold the bomb button until the missile fires or until the launch is aborted due to missile malfunction.

Note

After firing the first (left) missile, the fire signal is automatically directed to the selected right wing station the next time the bomb button is depressed.

Right Wing Station

If the first missile is to be launched from the right wing station, and the left wing stations also contain armament, proceed as follows:

1. Master arm switch - ARM
2. Station selector knob - OFF
   Select the OFF position to safe the missile launch circuit.
3. Gam-aux switch - INTERRUPT (hold)
   Hold the momentary interrupt position until after step 4 below.

Note

The AC can avoid transmitter output at this time by doing one of two things: (1) Hold the Gam-aux switch in INTERRUPT during step 4 below, or (2) position the weapon selector to BOMBS SINGLE, then re-select GAM-83 after step 4.

4. Bomb button - DEPRESS MOMENTARILY
   Momentarily depress the bomb button to set the intervalometer so that the next fire signal goes to the right station.
5. Gam-aux switch - RELEASE
6. Station selector knob - INBD or OUTBD WING (LOADED STATIONS)
7. Bomb button - DEPRESS (2 sec. approx)
   Depress and hold the bomb button until the missile fires, or until the launch is aborted due to missile malfunction.

Note

If the transmitter timer is energized during step 4 above, step 7 should follow rapidly thereafter so that the time cycle (50 ± 10 sec.) is only slightly expired. Otherwise, the AC may reset the timer by selecting GAM-AUX INTERRUPT, and then selecting NORM as the missile fires.

MISSILE FLIGHT (AGM-12E)

To prevent AGM-12E warhead from functioning:

1. Gam-aux switch - INTERRUPT (hold 4 sec.)
   If it becomes necessary to safe the missile, select Gam-aux INTERRUPT.

AFTER MISSILE ATTACK

1. Armament switches - OFF/SAFE
   a. Master arm switch - SAFE
   b. Station selector knob - OFF
2. Emergency vent handle - CYCLE
   Pull to de-pressurize, then push to pressurize to cycle cockpit air in case of contamination by missile exhaust gages.

BEFORE LANDING

1. Master arm switch - SAFE
2. Station selector knob - OFF
3. All DCU-94/A station selector switches (5) - AFT.
4. Missile arm switch - SAFE
5. Missile power switch - OFF
6. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW
3. AFTO Form 259 - COMPLETE

SUU-20 BOMB/ROCKET DISPENSERS (F-4C)

PREFLIGHT

Refer to part 4.

INFLIGHT

ROCKET DELIVERY

1. Optical sight - SET
2. Weapon selector knob - RKTS & DISP
3. Station selector knob - LOADED STATION
4. Intrvl switch - .10 or .14 ONLY
5. Master arm switch - ARM
6. Bomb button - DEPRESS

BOMB DELIVERY

1. Optical sight - SET
2. Weapon selector knob - BOMBS MODE
   a. With one dispenser aboard - PAIRS

WARNING

If the SUU-20 containing both rockets and bombs is aboard, and an empty TER is aboard the opposite station (2 and 8), applying the bomb release signal in a BOMBS PAIRS mode may also launch a rocket. The stepper circuits in the TER cause a feedback pulse which may be of sufficient duration to cause the rocket launch.

3. Intrvl switch - .10 or .14
4. Station selector knob - LOADED STATION
5. Master arm switch - ARM
6. Bomb button - DEPRESS

Note

- There is no cockpit indication to determine that all bombs or rockets have been released or fired.
- The intervalometers within the SUU-20 can not be rehomed in flight for an attempt to release or fire a hung bomb or rocket.
- Do not use an aircraft interval setting of 0.06.

BEFORE LANDING

1. Master arm switch - SAFE
2. Station selector knob - OFF
3. All DCU-94/A station selector switches (5) - AFT
4. Missile arm switch - SAFE
5. Missile power switch - OFF
6. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

SUU-21/A BOMB DISPENSER DCU-94/A (F-4C)

PREFLIGHT

Refer to part 4, cockpit weapons check and Exterior Inspection (SUU-21/A) -

INTERIOR INSPECTION (DCU-94/A)

Before applying external power:

1. All station selector switches (5) - AFT
2. Station select switch guard - INSTALLED
   If other munitions are aboard, the required guard should be installed.
3. Master release lock switch - AFT
4. Option selector knob - OFF
5. Bomb mode select knob - OFF
6. (P) Nuclear store consent switch - SAFE

With the dispenser doors open, proceed as follows:

7. External power - APPLY
8. Generator switches - EXT ON
9. Lamp test button - PRESS
   a. Warn and unlocked lights - ON
10. Option selector knob - SAFE
    a. Loaded station warn light(s) - FLASHING (doors closing)
    b. Loaded station warn light(s) - OFF (doors closed)
11. Option selector knob - OFF

INFLIGHT

ON BOMB RANGE (DCU-94/A)

1. Option selector knob - SAFE
2. Loaded station select switch - FORWARD
   a. Loaded station WARN light - ON
3. (P) Nuclear store consent switch - REL/ARM
   a. Loaded station WARN light - OFF
4. Option selector knob - GRD
   a. Loaded station WARN light - FLASHING (doors opening)
   b. Loaded station WARN light - ON (doors open)
5. Delivery mode selector knob - AS REQUIRED
6. Weapon selector knob - NOT RKTS & DISP

Note

When the SUU-21/A dispenser is loaded on the inboard stations, bomb release will not occur if the weapon selector knob is on RKTS & DISP.

BEFORE BOMB RUN (DCU-94/A)

1. Master release lock switch - FORWARD
   a. Loaded station UNLOCKED light - ON
2. Loaded station WARN light - ON

AFTER BOMB RELEASE (DCU-94/A)

Manual Operation

After each bomb release, the dispenser doors remain open and additional switching procedures are unnecessary. With DIRECT bombing mode selected, the release system (pickle button) is hot. If it is necessary to safe the system between runs, place the master release lock switch AFT, and reselect FWD just prior to the next run.

Automatic Operation

1. At bomb release, loaded station WARN light - FLASHING
2. Loaded station WARN light - OFF (doors closed)
3. Option selector knob - SAFE
4. Option selector knob - GRD
   a. Loaded station WARN light - FLASHING
   b. Loaded station WARN light - ON (doors open)

AFTER FINAL BOMB RELEASE (DCU-94/A)

1. (Auto mode) Loaded station WARN light - FLASHING
2. (Auto mode) Loaded station WARN light - OFF (doors closed)
3. Option selector knob - SAFE
   a. (Man. mode) Loaded station WARN light - FLASHING
   b. (Man. mode) Loaded station WARN light - OFF (doors closed)
4. Master release lock switch - AFT
   a. Loaded station UNLOCKED light - OFF
5. Bomb mode selector knob - OFF

WARNING

If the dispenser doors do not close and all bombs have not been expended, the aircraft must be flown to avoid populated areas to the greatest degree practicable.

AFTER LANDING (DCU-94/A)

To open dispenser doors, if required:

1. (P) Nuclear store consent switch - REL/ARM
2. Loaded station select switch - FORWARD
3. Option selector knob - GRD
   a. Loaded station WARN light - FLASHING
   b. Loaded station WARN light - ON (doors open)
4. All electrical power - REMOVED

Note

All electrical power must be removed from the aircraft before performing steps 5, 6 and 7 to preclude the dispenser doors from closing.

5. Option selector knob - OFF
6. All station select switches (5) - AFT
7. (P) Nuclear store consent switch - SAFE

SUU-21/A BOMB DISPENSER MODIFIED (F-4C)

PREFLIGHT

Refer to part 4.

INTERIOR INSPECTION

If the dispenser doors are open, close the doors as follows:

1. External power - APPLY
2. Generator switches - EXT ON
3. Armament safety override - DEPRESS
4. Station selector knob - INBD
5. Master arm switch - ARM
6. Arm nose tail switch - NOSE
   a. Dispenser doors - CLOSE (Crew Chief Check)
7. Station select knob - OFF
8. Master arm switch - OFF

INFLIGHT

WEAPON RELEASE

1. Optical sight - SET
2. Weapon selector knob - BOMBS MODE
   a. With one dispenser aboard - PAIRS
3. Station selector knob - INBD
4. Master arm switch - ARM
5. Arm nose tail switch - NOSE & TAIL
   a. Dispenser doors - OPEN (Wingman Check)
6. Bomb button - DEPRESS

AFTER FINAL RELEASE

1. Arm nose tail switch - NOSE
   a. Dispenser doors - CLOSE (Wingman Check)
2. Master arm switch - SAFE
3. Station selector knob - OFF
4. Sight mode selector knob - OFF

AFTER LANDING

To open SUU-21/A Dispenser Doors:

1. Armament safety override button - DEPRESS
2. Station selector knob - INBD
3. Master arm switch - ON
4. Arm nose tail switch - NOSE & TAIL
   a. Dispenser door - OPEN
5. Station selector knob - OFF
6. Master arm switch - SAFE

TDU-11/B TARGET ROCKET (5-INCH HVAR) (F-4C)

PREFLIGHT

Refer to figure 2-30.

INFLIGHT

To fire the target rocket, perform the following procedures:

1. Optical sight - SET AS DESIRED
2. Missile select switch - HEAT
3. Applicable SW light - ON
   If the SW light indicates that the station containing the target rocket is not selected, actuate the missile select switch to HEAT REJECT until the desired station is selected.
4. Missile arm switch - ARM
   a. READY light - ON
5. Trigger switch - ACTUATE
   After the target rocket is fired, maneuver aircraft to pursue the target rocket, monitor the aural tone in the headset, and prepare to launch the AIM-9 missile at the target rocket. Prior to launching the AIM-9 missile, observe proper SW and READY light indications, aircraft to target range, and proper tone indication.

BEFORE LANDING

1. Master arm switch - SAFE
2. Station selector knob - OFF
3. All DCU-94/A station selector switches (5) - AFT
4. Missile arm switch - SAFE
5. Missile power switch - OFF
6. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

MODIFIED A/A 37U-15 TOW TARGET SYSTEM (F-4C)

PREFLIGHT

Refer to part 4, figure 2-29.

INFLIGHT

PRE-TAKEOFF

To reduce rolling tendencies immediately after takeoff, the following aileron trim positions are recommended. Trim settings are the same with or without centerline tank.

a. Dart system on station 1, station 9 empty: 2.5 inches left aileron down (trim 2.5 seconds to right of neutral), 1.5 inches right rudder (trim 1.5 seconds to right of neutral).

b. Dart system or station 1, external fuel tank on station 9: 3.5 inches right aileron down (trim 3.5 seconds to left of neutral), 1.0 inch left rudder (trim 1.0 second to left of neutral).

Note

The tow target system, carried on the left outboard wing station, may induce 20° to 30° errors in the remote compass transmitter. Due to this effect, the DG mode on the compass controller should be selected.

TAKEOFF

Initiate a slow pitch rotation at 140 KIAS to obtain 8° pitch attitude indicated on the ADI for lift-off at 180 to 190 KIAS. Decrease thrust after gear and flap retraction to ensure that 275 KIAS is not exceeded.

Note

Refer to T.O. 1F-4C-1 External Store Limitations for A/A 37U-15 tow target system inflight limitations.

TARGET DEPLOYMENT

1. Weapon selector knob - BOMBS PAIRS or BOMBS SINGLE
   Bombs single may be selected if there is a deployable store on the right outboard wing station, in which case the reset switch must be positioned to RESET every time prior to pressing the bomb release button.
2. Station selector knob - OUTBD WING
3. Arm nose tail switch - SAFE
4. Step switch - RESET (if applicable)
5. Master arm switch - ARM
6. Bomb button - DEPRESS
   Depressing the bomb button once will release the target.

CAUTION

Do not attempt to deploy a damaged dart target. Motion of the damaged target after launch is unpredictable. Possible contact with the aircraft could be hazardous.

7. Master arm switch - SAFE

CABLE CUT

1. Master arm switch - ARM
2. Step switch - RESET (if applicable)
   If BOMBS - SINGLE is selected, the reset switch must be positioned to RESET in order to return the release signal to the left wing station
3. Tow cable - CUT
   a. (Before Rev. K) Bomb button - DEPRESS
   b. (After Rev. K) Arm nose tail switch - NOSE
4. Chase plane, acknowledge cable cut.

Emergency Cut

1. Arm nose tail switch - NOSE & TAIL or TAIL
2. Chase plane, acknowledge cable cut

BEFORE LANDING

1. Master arm switch - SAFE
2. Station selector knob - OFF
3. All DCU-94/A station select switches (5) - AFT
4. Missile arm switch - SAFE
5. Missile power switch - OFF
6. Missile jett knob - OFF

LANDING WITH STOWED TARGET (DAMAGED OR UNDAMAGED)

1. Flaps - 1/2
2. Angle of attack - 17 to 18 UNITS
   (With wing tank use less than 17 units.)

INFLIGHT PROCEDURES FOR BOMBING RANGE SELECTED WEAPONS (F-4C)

These procedures are included for easy inflight reference to support typical bombing, rocket, and strafe missions on the bomb range. Aircrews are still required to use appropriate checklists for preflight and jettison operations. Only the numbered items need be performed; sub-steps are added for clarity.

INFLIGHT

ROCKET LAUNCHERS AND SUU-20

1. Reticle depression knob - SET
2. Weapon selector knob - RKTS & DISP
3. Intrvl switch - .10 or .14 ONLY
4. Station selector knob - AS REQUIRED
5. Master arm switch - ARM

BOMBS - SUU-20

1. Reticle depression knob - SET
2. Weapon selector knob - BOMBS
3. Intrvl switch - .10 or .14 ONLY
4. Station selector knob - AS REQUIRED
5. Master arm switch - ARM

BOMBS-SUU-21/A(DCU-94/A)

1. Reticle depression knob - SET
2. Delivery mode - SELECT
3. Weapon selector knob - BOMBS
4. Option selector knob - SAFE
5. Loaded station selector switch - FORWARD
   a. WARN light - ON
6. Nuclear store consent switch - REL/ARM
   a. WARN light - OFF
7. Option selector knob - GRD
   a. WARN light - FLASH
   b. WARN light - ON
8. Master release lock switch - FORWARD
   a. UNLOCKED light - ON

Note

For automatic operation, open doors by repeating steps 4 and 7.

After Final Release (DCU-94/A)

1. Option selector knob - SAFE
   a. WARN light - FLASH/OFF
2. Master release lock switch - AFT
   a. UNLOCKED light - OFF
3. Loaded station select switch - AFT
4. (WSO) Nuclear consent switch - SAFE

BOMBS, SUU-21/A (MODIFIED)

1. Reticle depression knob - SET
2. Weapon selector knob - BOMBS MODE
   a. With one dispenser aboard - PAIRS
3. Station selector knob - INBD
4. Master arm switch - ARM
5. Arm nose tail switch - NOSE & TAIL
   a. Dispenser doors - OPEN (Wingman Check)

After Final Release (SUU-21/A Modified)

1. Arm nose tail switch - NOSE
   a. Dispener doors - CLOSE (Wingman Check)
2. Master arm switch - SAFE
3. Station selector knob - OFF

STRAFE SUU-16/A, 23/A

1. Reticle depression knob - SET
2. Gun clear switch - AS REQUIRED
3. Gun station select switch - READY
4. Master arm switch - ARM

RANGE DEPARTURE

1. Sight mode selector knob - OFF
2. Delivery mode selector knob - OFF
3. Master arm switch - SAFE
4. Station selector knob - OFF

PART 2 NORMAL AIRCREW PROCEDURES F-4D

TABLE OF CONTENTS

OPTICAL SIGHT CHECK (F-4D)

During the following procedures, the AC has the option of using the BIT masks or noting the position of the pipper on the ground to determine the magnitude of reticle movement. Prior to selecting BIT 1, the AC should position his head to the right until one-half of the reticle is removed by the BIT 1 mask. The BIT 2 mask must be rotated forward to remove the top half of the reticle prior to selecting BIT 2. Radar power must be available at least 30 seconds prior to performing the BIT 2 check. For proper BIT check, a 10-Mil sight depression must be used.

CAUTION

To avoid gyro system damage and to get an accurate BIT check, gunsight BIT checks should be performed only when the aircraft is stopped or in level unaccelerated flight.

Note

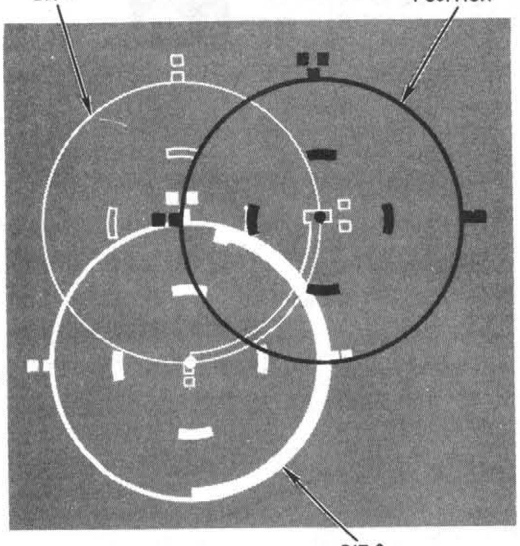
Some aircraft do not have BIT masks.

1. Sight mode selector knob - STBY (Remain for 30 sec.)
   The sight mode switch should remain in STBY for 30 seconds to provide warmup power prior to selecting other modes; however, this will not damage the set if not accomplished.
2. (P) Radar power - TEST or STBY

CAUTION

Radar power should remain OFF until the aircraft is operating on internal power and with engines running over 50% rpm minimum. This prevents overheating of radar components.

3. Sight shutter lever - OPEN
4. Sight mode selector knob - CAGE
   Reticle should appear on the combining glass.
5. Reticle intensity control - CHECK
   Check that the reticle intensity can be controlled.
6. Reticle depression counter - SET 10 MILS
7. Sight mode selector knob - CAGE to A/G to A/A
   a. Pipper at RBL, note position of pipper.
   b. Check ± 2 mils between modes
      With the sight mode selector knob in CAGE, note the position of the pipper on the ground, then rotate the sight mode selector knob from CAGE to A/G, and then to A/A. There should not be more than 2 mils difference between the three positions. This is the radar boresight line (RBL).



Notes

a. 10 mils must be set into manual depression window for proper read-out of BIT tests functions.

b. Rear cockpit radar power switch must be out of "Off" position for at least 30 seconds.

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Figure 2-7

Note

When the sight mode selector knob is positioned to CAGED, A/A, A/G, it remains caged to the radar boresight line regardless of the reticle depression counter setting. This is true only when the aircraft is on the ground; when airborne, the sight functions normally.

8. Sight mode selector knob - BIT 1
   a. The reticle should jump 25 ± 4 mils horizontally to the left (figure 2-7).
   b. The roll tabs should rotate 90° clockwise.
   c. The range bar should indicate 4000 feet (3 o'clock position).

Note

Radar power must be available 30 seconds prior to performing BIT 2.

9. Sight mode selector knob - BIT 2
   a. The reticle should jump 25 ± 4 mils down from the BIT 1 position (figure 2-7).
   b. The range bar should indicate 6700 feet (12:30 o'clock position).
   c. Roll tabs should indicate level flight.
10. Sight mode selector knob - A/A
    a. The pipper should return to the radar boresight line.

Optical Sight/Radar Tie-In

11. (AC) All armament switches - OFF/SAFE
    a. Station green/amber light - OFF
12. Armament safety override button - PUSH IN

WARNING

When the armament safety override button is energized, the jettison circuit is placed in an inflight configuration, regardless of the landing gear handle position. The panic button will jettison all external stores. When the armament safety override button is pushed IN, the AC has a jettison capability during takeoff while weight is on the gear.

13. (P) Radar range - R1
14. (P) Track switch - MANUAL
15. Radar Mode selector knob - MAP, RDR or BST
16. (P) Action switch HA, position gate at 2 NM and depress to FA.
    a. (AC) Range bar indicates 12, 000 ft. (3 o'clock)
17. (AC-P) Rotate manual Vc knob to obtain 200 knots closure; range bar begins moving toward 5 o'clock (6000 ft.) position.
18. (AC) Weapon selector - GUNS
19. (AC-P) Master arm switch - ARM (at 6000 ft.)
    a. Range bar jumps to 1 o'clock.
    b. Reticle slowly depresses 4 to 5 mils.
    c. Range continues decreasing. Inside 4000 ft. (3 o'clock), the pipper rises 4 to 5 mils as range approaches 1500 feet. Stop the range bar at 1500 feet (V_C knob zero closure).
20. (AC) Reticle cage (ARR) button - DEPRESS AND HOLD
    a. Pipper should move not more than one mil.
21. (P) Action switch - HA and RELEASE
    a. Radar breaks lock, range bar - OFF
22. (AC) Reticle cage (ARR) button - RELEASE
    a. Pipper should move no more than one mil.
23. (AC) Master arm switch - SAFE
24. (AC) Sight mode selector knob - STBY or CAGE

CAUTION

The sight should be caged for takeoff and for landing. Select STBY or CAGE to prevent damage to the mirror drive assy.

25. (AC) Shutter lever - CLOSE (if leaving the airplane).
    If further use of the sight is not anticipated, close the shutter to prevent sun light from entering opticle system.

OPTICAL SIGHT MALFUNCTION INDICATIONS F-4D

ITEM	BIT MODE	MALFUNCTION	OPTICAL SIGHT STATUS
RETICLE ELEVATION	BIT 1	Reticle goes to +10 mils with -10 set in the manual depression control.	The manual depression CDX is functioning, but cannot be manually adjusted. Sight is useless for WRCS laydown, dive bombing, rockets, air-to-ground, and guns air to ground. Dive toss, dive laydown, missile and guns air-to-air and offset bombing modes are operational.
	BIT 2	Reticle remains at RBL.	There is either no effect, or all modes except WRCS laydown, missiles and guns air-to-air, and offset bomb will be inoperative.
	BIT 1	Reticle drives to bottom of combining glass.	All modes are inoperative.
	BIT 1	Reticle drives 35 mils to top of the combining glass.	WRCS laydown may be affected.
	BIT 2	Reticle drives down but not to 25 mils.	Correct lead angles are not being generated and lead computing operation is in error.
RETICLE AZIMUTH	BIT 1	Reticle remains at RBL.	The sight may remain at the RBL in all modes. It is also possible that the sight may not respond to drift signals applied to dive laydown, WRCS laydown, or dive toss. However, lead computing operation is unaffected.
	BIT 1 and BIT 2	Reticle travels to extreme left of combining glass.	Lead computations are incorrect.
	BIT 2	Reticle remains at RBL in azimuth after being 25 mils to left in BIT 1.	BIT malfunction - should not affect lead computing mode.
RETICAL MOTION	BIT 1 and BIT 2	Reticle remains at RBL in elevation and azimuth.	The reticle may remain fixed at the RBL in all modes.
	BIT 1 and BIT 2	Jittery Reticle.	Open loop from tachometer. This defect will be present in all modes of operation.

F4D-34-II-209-1

Figure 2-8 (Sheet 1 of 2)

OPTICAL SIGHT MALFUNCTION INDICATIONS (CONT.)

ITEM	BIT MODE	MALFUNCTION	OPTICAL SIGHT STATUS
RANGE BAR	BIT 1 and BIT 2	Range bar is in stow position.	Analog bar will remain stowed in all modes of operation and lead computing operation will not be possible.
	BIT 1	Range bar is at 1500' position.	BIT malfunction - the analog bar should function properly in all operational modes. Ranging and lead computation may be correct.
	BIT 2	Range bar is at 1000' or 4000' position.	
	BIT 1 and BIT 2	Range bar keeps driving.	Open loop - no feedback voltage from the follow-up pot. This defect will be present in all modes of operation.
	BIT 1 and BIT 2	Range bar is jittery.	No tachometer feedback to stabilize servo amplifier. This defect will be present in all modes of operation.
	BIT 1 and BIT 2	Range bar sticks.	Probably a mechanical bind is present. No mode of operation will be free of this defect.
ROLL TABS	BIT 1	Roll TABs remain at wings level.	BIT malfunction, the roll tabs may or may not work in flight.
	BIT 1 and BIT 2	Roll tabs rotate continuously.	Open loop - no feedback signal. Roll loop will not function in any mode of operation.
	BIT 1 and BIT 2	Jittery roll tabs.	No tachometer feedback. This defect will show up in all modes of operation.

F4D-34-11-209-2

Figure 2-8 (Sheet 2 of 2)

WRCS BIT CHECK (F-4D)

1. Delivery mode selector knob - OFF
2. HSI mode switches - NAV COMP
3. (P) Weapon delivery panel switches - SET
   a. Activate switch - NORMAL
   b. Tgt find switch - NORMAL
   c. Range switch - X100
      F-4D-32 and up; and all others after T.O. 1F-4-702.
4. (P) Control panel counters - SET
   a. Target distance N/S - N274
   b. Target distance E/W - E114
   c. Target alt range - 170
   d. Drag coefficient - 2.00
   e. Release advance - 900
   f. Release range - 050
      (Use 500 if step 3c is X10)

Note

A NO-GO indication will occur if the above parameters are not used during BIT.

CAUTION

When the target alt range counter is set greater than 000, do not energize the target find nor offset bomb mode unless; the aircraft altitude is greater than the altitude set in the target alt range counter, or the WRCS BIT button is depressed while performing the WRCS target find offset bomb BIT check (step 14).

5. (P) INS mode selector knob - ALIGN or NAV
6. (P) BDHI mode switch - NAV COMP
7. (P) Radar mode switch - MAP-PPI
8. (P) Radar range switch - R1
9. (P) Radar power - STBY
10. (P) BIT selector knob - LAYDOWN, PUSH and HOLD
    a. Freeze button - PUSH ON (after 5 sec)
    b. Range indicator illuminates.
    c. After 15 seconds - GO/NO-GO
11. (P) BIT selector knob - DIVE LAYDOWN, PUSH and HOLD
    a. Freeze button - PUSH ON (after 5 sec)
    b. After 15 seconds - GO/NO-GO
12. (P) BIT selector knob - DIVE TOSS, PUSH and HOLD.
    a. Freeze button - PUSH ON (after 5 sec)
    b. After 15 seconds - GO/NO-GO
13. (P) BIT selector knob - AGM-45, PUSH and HOLD
    a. BDHI and HSI miles counter - 7.6 ± 0.5 NM
    b. Alt indicator illuminates.
    c. After 5 seconds, freeze button - PUSH ON.
    d. Miles counter begins to decrease.
    e. Approach indicator should indicate a pullup command (LOW).
    f. After 10 seconds, approach indicator should indicate a level command (CENTER).
    g. After 5 seconds - GO/NO-GO
    h. After 5 seconds, approach indicator should indicate a dive command (HIGH).
14. (P) BIT selector knob - TGT FIND OFFSET BOMB
    a. (P) BIT button - PUSH AND HOLD
       The BIT button must be held depressed without interruption until completion of step 14o.

CAUTION

When the BIT button is depressed, the WRCS computer receives an aircraft altitude input that is higher than the target altitude inserted in step 4c. Step 14a must be performed before steps 14b and 14c to ensure the WRCS computer does not receive an aircraft altitude input that is lower than the target altitude inserted in step 4c. This is necessary to avoid possible damage to the WRCS pitch servo.

   b. (AC) Delivery mode selector knob - TGT FIND or OFFSET BOMB (check aircraft effectivity).
   c. (AC) Armament safety override button - PUSH IN (check aircraft effectivity).

WARNING

When the armament override button is energized, the jettison circuit is placed in an inflight configuration, regardless of the landing gear handle position. The panic button will jettison all external stores. The armament safety override button will pop out when the landing gear handle is raised.

Note

Steps 14b and 14c are not required and should not be performed in F-4D-32 and up; and all others after T.O. 1F-4-702.

   d. (P) Along track cursor control - MOVE (After 5 sec).
      Move the along track cursor control first in a forward direction to cause the along track cursor to appear and move well up on the scope before stopping it by releasing the cursor control. Improper operation of the along track cursor control can cause the WRCS computer to function as though the RIP were behind the aircraft; i.e., the cross track cursor responds in a reverse direction to that normally obtained when the cross track cursor control is operated.

e. (WSO) Cross track cursor - MOVE
   Outboard movement of the cross track cursor control causes the cursor to move to the right.
f. (WSO) Reset button - PUSH
g. (WSO) Cursors should return to center cross track and zero range.
h. (WSO) Target insert button - PUSH ON
i. (WSO) Along track cursor; 6.5 miles on 0° grid line (± 2000 feet). Cross track cursor; right 30° (± 1.5°).
j. HSI bearing pointer should read 23° ± 2.5° to the right of the lubber line and the TGT mode light on the HSI illuminates.
k. (WSO) BDHI No. 1 needle should read 23° ± 2.5° to the right of the top index.
l. (AC-WSO) HSI and BDHI miles counters should read 4.8 ± 1.0 NM.
m. ADI vertical pointer should deflect full right of center.
n. (WSO) Freeze button - PUSH ON
   Miles counter decreases to zero, then increases. The sight roll tabs rotate as the HSI miles counter passes through zero.
o. (WSO) After 15 seconds - GO/NO-GO

15. (WSO) WRCS control panel counters - RESET
    a. Target distance N/S - N243
    b. Target distance E/W - E/W Zero
    c. Target alt range - 243
16. (WSO) Radar Power - TEST
17. (WSO) Test Switch - TEST 1
18. (WSO) WRCS BIT button - PUSH and HOLD
    a. (WSO) Reset button - PUSH
    b. (WSO) Target insert button - PUSH ON
    c. (WSO) Along track cursor; 5.0 miles, checked against the 5th BIT target. The near edges of each should exactly coincide. Radar receiver gain must be reduced to observe the along track cursor.
    d. (AC, WSO) Crosstrack cursor; zero azimuth (± 1.5°). Note the actual position of the azimuth cursor for in-flight evaluation of aircraft steering indicators (BDHI - HSI - ADI).
    e. HSI bearing pointer should read under aircraft lubber line (± 2.5°), sight roll tabs level, and ADI vertical pointer centered.
    f. (WSO) BDHI No. 1 needle under lubber line (± 2.5°).
19. Delivery mode selector knob - OFF (check aircraft effectivity)
    This step is performed only if steps 14b and 14c are performed.
20. (WSO) WRCS BIT selector knob - RELEASE and OFF
    Release the BIT button and position the BIT selector knob to OFF.
21. (WSO) Target alt range counter - SET 000

Note

- The B-sweep may not be centered on the scope because of erroneous drift inputs to the radar MAP-PPI and A/G mode when performing this BIT check on the ground.
- If aircraft power is interrupted or fluctuates during a BIT check, a NO-GO indication may result and the BIT check should be repeated.
- If a momentary NO-GO is indicated as the BIT button is released, disregard indication if a GO was obtained with the button depressed.

22. (WSO) Weapon delivery panel - CHECK
    a. Target find switch - NORM
    b. Range switch - NORM
23. (WSO) Radar power - AS REQUIRED

BOMBS (F-4D)

PREFLIGHT

Refer to part 4.

INFLIGHT

Note

After T.O. 1F-4-750 (BRU-5/A rack), the following release procedures may be used to release the M118 or MK 84 GP bomb from the CL station. On unmodified aircraft, the DCU-94/A procedures may be used.

DIRECT DELIVERY MODE

Bomb Release-Armed

1. Delivery mode selector knob - DIRECT
2. Sight mode selector knob - A/G
3. Reticle depression knob - SET
4. Weapon selector knob - BOMBS
5. Arm nose tail switch - SET
6. Intrvl switch - SET (if applicable)
7. Station select - LOADED STATION
   a. Green light(s) - ON
8. Master arm switch - ARM
   a. Amber light(s) - ON
9. Bomb button - DEPRESS
   a. Pullup light - ON
   b. When station is empty, amber light - OFF

Emergency Bomb Release

1. Weapon selector knob - BOMB/RIPPLE
2. Repeat above steps 5 through 9, hold bomb button depressed 4 seconds.

If all bombs do not release:

3. Weapon selector knob - RKTS & DISP
4. Weapon selector knob - BOMB/RIPPLE
5. Bomb button - DEPRESS (hold 4 seconds)

DIVE TOSS/DIVE LAYDOWN

Before Bomb Run

1. Delivery mode selector knob - DIVE TOSS or DIVE LAY
2. Sight mode selector knob - A/G
   The sight reticle is electrically caged to the radar boresight line and is drift stabilized.
3. HSI mode switches - NAV COMP
   If the HSI indications are to be used, the NAV COMP position must be selected.
4. (P) INS mode selector knob - NAV
5. (P) Radar mode selector knob - AIR-GND
6. (P) Radar range - R1
7. (P) Radar power - OPR
   B-sweep, acquisition symbol, and el strobe centered on scope.
8. (P) Antenna stab switch - NOR
9. (P) WRCS drag coefficient counter - SET (Dive Toss Only)
10. (P) WRCS release range counter - SET (Dive Lay Only)
    a. Range switch - NORM or X100

Note

The position of the range switch will affect the value placed in the release RANGE readout: times 10 (NORMAL), or times 100. (F-4D-32 and up; and all others after T.O. 1F-4D-702.)

11. (P) WRCS release advance - SET (if required)
12. Weapon selector knob - BOMBS
13. Arm nose tail switch - SET
14. Intrvl switch - SET (if required)

Note

The optical sight and the radar antenna is drift stabilized. Additional upwind correction must be made for the wind effect on the high drag bombs. Wind correction is not required for the low drag bombs (M117, etc.).

15. Station selector button(s) - PUSH ON
    a. Green light(s) - ON
16. Master arm switch - ARM
    a. Amber light(s) - ON

Bomb Run

1. (P) Receiver gain - MINIMUM
2. (P) Lockon target (CALL)
3. Bomb release button - DEPRESS AND HOLD
   a. After bomb release, pullup light - ON
   b. After station is empty, amber light - OFF
   During the initial dive toward the target area, the pilot reduces the receiver gain to obtain a single return, depress the action switch to Half Action, place the range strobe in the center of the return, and then depress the action switch to Full Action and release. After lockon, the AC places the pipper on target, depresses and holds the bomb release button, and initiates the desired delivery maneuver. After the bomb is automatically released, the pullup light will illuminate and will go out when the bomb button is released. The amber light will go out when the station is empty.

LAYDOWN

Before Bomb Run

1. Delivery mode selector knob - LAYDOWN
2. Sight mode selector knob - A/G
3. Reticle depression counter - SET (if required)
   Set the IP-to-target sight setting.
4. HSI mode switches - NAV COMP
   If the HSI steering information is to be used, the NAV COMP position must be selected.
5. (P) INS mode selector knob - NAV
6. (P) WRCS target range counter - SET
   Set the distance from IP to target.
7. (P) WRCS release range counter - SET
   a. Range switch - NORM or X100
8. (P) WRCS release advance counter - SET (if required)
9. Weapon selector knob - BOMBS
10. Arm nose tail switch - SET
11. Intrvl switch - SET (if required)
12. Station selector button(s) - PUSH ON
    a. Green light - ON
13. Master arm switch - ARM
    a. Amber light - ON

Bomb Run

Approach the target at the preplanned release altitude and airspeed. When the aircraft is directly over the IP, or when the pipper is on target, depress and hold the bomb release button. Maintain a constant airspeed, altitude, and course until the bomb is automatically released. The pullup light will illuminate to indicate bomb release and will go out when the bomb button is released. Wind corrections for the bomb must be applied prior to depressing the bomb button.

1. Bomb release button - DEPRESS AND HOLD
   a. At bomb release, pullup light - ON
   b. When a station is empty, amber ready light - OFF

OFFSET BOMBING/TARGET FIND

Before IP

1. Delivery mode selector knob - OFFSET BOMB or TGT FIND
2. Sight mode selector knob - A/G
   The optical sight reticle is electrically caged to the RBL and to 0° in azimuth. The roll tabs display aircraft attitude until target insert, then steering commands to the target.
3. Navigation mode selector knob - NAV COMP
4. HSI mode switches - NAV COMP
   If the HSI indications are to be used, the NAV COMP position must be selected.
5. (P) INS mode selector knob - NAV
6. (P) BDHI mode switch - NAV COMP
7. (P) Weapon delivery panel - SET
   a. Activate switch - NORMAL
   b. Tgt find switch - NORMAL
   c. Range switch - AS REQUIRED

Note

The position of the range switch will affect the value placed in the release RANGE readout: times 10 (NORMAL), or times 100. (F-4D-32 and up, and all others after T.O. 1F-4D-702.)

8. (P) WRCS input counters - SET
   a. Target distance N/S - 100-ft. increments
   b. Target distance E/W - 100-ft. increments
   c. IP altitude MSL - 100-ft. increments
   d. Release range - 10-ft. or 100-ft. increments (Offset bomb)
   e. Release advance - Milliseconds (Offset bomb, if required)
9. Weapon selector knob - BOMBS (Offset bomb)

Note

The ADI will not provide steering if the weapon selector knob is on AGM-45.

10. Arm nose tail switch - SET
11. Intrvl switch - SET (if required)
12. Station selector button(s) - PUSH ON
    a. Green light - ON
13. Master arm switch - ARM
    a. Amber light - ON

Bomb Run-Offset Radar IP

1. (P) Radar power - OPR
2. (P) Radar mode switch - MAP-PPI
3. (P) Antenna stab switch - NOR
4. (P) Cursor intensity - ADJUST
5. (P) Antenna elevation - ADJUST
6. (P) Scan switch - WIDE
7. (P) Radar range selector knob - R1
8. (P) Operate the along track cursor to position the range cursor over the RIP.
9. (P) Operate the cross track cursor to position the offset cursor over the RIP.
10. (P) Freeze button - PUSH ON

Note

- The along track cursor must be moved first to initiate cursor control. Position the intersection of the cursors over the RIP and then push the freeze button ON: the cursors begin tracking the RIP. The cursors can be moved to touch-up the intersection location over the RIP after the Freeze button is pushed on.

- Do not position the range cursor below zero range. If the range cursor is moved below zero range and then moved out over the IP, the steering information will be in error by 180° even though the cursor responds normally to along track cursor control movements.

11. (P) Target insert button - PUSH ON
    The steering instruments display steering commands when the target insert button is pushed ON, and the cursor intersection will position over the target location and track the target. If the target is on the scope, set the target elevation on the ALT RANGE counter and touch-up the cursors over the target.
12. Bomb release button - DEPRESS AND HOLD (Offset bomb)
    a. At bomb release, pullup light - ON
    b. When a station is empty, amber light - OFF
       When the aircraft is on course to the target and at the preplanned release altitude and airspeed, depress and hold the bomb release button until the bomb is released, as indicated by illumination of the pullup light.

Note

The roll tabs rotate as the target is passed, and the BDHI and HSI distance-to-target counters will approach zero and then start increasing in value.

Bomb Run-Visual IP Fly-Over

1. (P) When over IP, freeze button and target insert button - PUSH ON
   When the aircraft is directly over the IP, the freeze button and the target insert button are pushed ON simultaneously. The steering instruments supply steering commands to the target, and the cursors will position over, and start tracking the target. If the target is visible on the scope, the pilot may touch-up the cursors when the target elevation is set in the ALT RANGE control.

2. Bomb release button - DEPRESS AND HOLD (Offset bomb)
   a. At bomb release, pullup light - ON
   b. When a station is empty, amber light - OFF
      When the aircraft is on course to the target and at the preplanned release altitude and true airspeed, depress and hold the bomb release button until bomb release occurs, indicated by the illumination of the pullup light.

Note

The roll tabs rotate as the target is passed, and the BDHI and HSI distance-to-target counters will approach zero and then start increasing in value.

LABS/OFFSET BOMB/TGT FIND

After Takeoff

1. Delivery mode selector knob - OFFSET BOMB or TGT FIND
2. (P) Target find switch - HOLD
   Select HOLD on the weapon delivery panel.
3. Sight mode selector knob - A/G
   The optical sight reticle is electrically caged to the RBL and to 0° in azimuth. The roll tabs display aircraft attitude until target insert, then steering commands to the target.
4. Navigation mode selector knob - NAV COMP
5. HSI mode switches - NAV COMP
   If the HSI indications are to be used, the NAV COMP position must be selected.
6. (P) INS mode selector knob - NAV
7. (P) BDHI mode switch - NAV COMP
8. (P) WRCS input counters - SET
   a. Target distance N/S - 100-ft increments
   b. Target distance E/W - 100-ft increments
   c. IP altitude MSL - 100-ft increments
   d. Release range - 10-ft or 100-ft increments (Offset bomb)
   e. Release range - LABS pullup range, 10-ft or 100-ft increments

Note

The (X100) factor is selected through the range switch on the weapon delivery panel.

   f. Release advance - Milliseconds (Offset bomb, if required)
9. Weapon selector knob - BOMBS (Offset bomb)

Note

The ADI will not provide steering if the weapon selector knob is on AGM-45.

10. Arm nose tail switch - SET
11. Intrvl switch - SET (if required)
12. Station selector button(s) - PUSH ON
    a. Green light - ON
13. Master arm switch - ARM
    a. Amber light - ON
14. (P) Dual timers - SET
    a. Pullup timer - T_1
    b. Release timer - T_2
15. (P) Release gyro - SET
    a. Low angle (LOFT) - DEG

Before Bomb Run

1. (P) Radar power - OPR
2. (P) Radar mode switch - MAP-PPI
3. (P) Antenna stab switch - NOR
4. (P) Cursor intensity - ADJUST
5. (P) Antenna elevation - ADJUST
6. (P) Scan switch - WIDE
7. (P) Radar range selector knob - R1

Bomb Run-Offset Radar IP

1. (P) Operate the along track control to position the range cursor over the RIP.
2. (P) Operate the Cross Track control to position the offset cursor over the RIP.
3. (P) Freeze button - PUSH ON

Note

- The along track cursor must be moved first to initiate cursor control. Position the intersection of the cursors over the RIP and then push the freeze button ON; the cursors begin tracking the RIP. The cursors can be moved to touch-up the intersection location over the RIP after the Freeze button is pushed on.
- Do not position the range cursor below zero range. If the range cursor is moved below zero range and then moved out over the IP, the steering information will be in error by 180° even though the cursor responds normally to along track cursor control movements.

4. (P) Target insert button - PUSH ON
   The steering instruments display steering commands when the target insert button is pushed ON, and the cursor intersection will position over the target location and track the target. If the target is on the scope, set the target elevation on the ALT RANGE counter and touch-up the cursors over the target.
5. Bomb release button - DEPRESS AND HOLD (Offset bomb)
   a. At bomb release, pullup light - ON
   b. When a station is empty, amber light - OFF
      When the aircraft is on course to the target and at the preplanned release altitude and airspeed, depress and hold the bomb release button until the bomb is released, as indicated by illumination of the pullup light.

Note

The roll tabs rotate as the target is passed, and the BDHI and HSI distance-to-target counters will approach zero and then start increasing in value.

Bomb Run-Visual IP Fly-Over

1. (P) When over IP, freeze button and target insert button - PUSH ON
   When the aircraft is directly over the IP, the freeze button and the target insert button are pushed ON simultaneously. The steering instruments supply steering commands to the target, and the cursor will position over, and start tracking the target. If the target is visible on the scope, the pilot may touch-up the cursors when the target elevation is set in the ALT RANGE control.
2. Bomb release button - DEPRESS AND HOLD (Offset bomb)
   a. At bomb release, pullup light - ON
   b. When a station is empty, amber light - OFF
      When the aircraft is on course to the target and at the preplanned release altitude and true airspeed, depress and hold the bomb release button until bomb release occurs, indicated by the illumination of the pullup light.

Note

The roll tabs rotate as the target is passed, and the BDHI and HSI distance-to-target counters will approach zero and then start increasing in value.

Bomb Run-LABS/TGT Find

1. Delivery mode selector (LABS) - AS REQUIRED
   Select the planned delivery mode.

Note

With the TGT find switch on HOLD, the delivery mode selector may be positioned to any LABS mode without losing WRCS function.

2. (P) Along track and cross track controls - AS REQUIRED (visual or radar IP)
3. (P) Freeze control - PUSH ON
4. (P) Target insert control - PUSH ON
5. (P) After target insert, activate switch - ON
   Select the ON position only after steering instruments have transitioned to target.
6. At warning tone (T_1 start) - MIL POWER PULLUP
7. Bomb button - DEPRESS AND HOLD

LOFT BOMBING-RIPPLE RELEASE

Before Bomb Run

1. (P) Activate switch - NORMAL
   When the WRCS is not used with the LABS modes, the target find switch and/or the activate switch on the weapons delivery panel must be positioned to NORMAL.
2. (P) Low angle knob - SET
3. (P) Pull up timer - SET
4. (P) Release timer - SET ZERO
5. Delivery mode selector knob - LOFT
6. Pedestal panel - SET
   a. Weapon selector knob - BOMB/RIPPLE
   b. Arm nose tail switch - NOSE & TAIL
   c. Intrvl switch - SET
   d. Station selector button(s) - PUSH ON
      (1) Green light - ON
   e. Master arm switch - ARM
      (1) Amber light - ON

At IP

1. Bomb button - DEPRESS AND HOLD
   The bomb button must be energized until the final bomb is released.
2. At pullup point, throttles - FULL MIL POWER

LOFT BOMB DELIVERY

Approach the IP at the preplanned altitude and true airspeed. When over the IP, depress and hold the bomb button energized until the final bomb is released. When the bomb button is depressed, the pullup light will illuminate, the pullup timer will begin, and the ADI pointers will center. Upon completion of the pullup timer, the pullup light and the reticle light will go out and the horizontal pointer will begin programming a 4-G pullup. This is the signal to the AC to select full military power and begin rotation into the pullup maneuver by flying the ADI pointers (4-G pullup) or the accelerometer. Since the sight reticle is pitch stabilized, it will not be in view above loft angles of 20°. When the aircraft attitude is at the preselected release angle, the pullup light and the reticle light illuminates and the bombs will begin releasing in a ripple sequence. After the final bomb is released, the bomb button is released and the AC initiates a wingover escape maneuver to achieve a 120° turn while diving toward minimum escape altitude. When the bomb button is released, the pullup light will go out, and the horizontal pointer will move out of view.

AFTER ESCAPE MANEUVER

1. Master arm switch - SAFE
2. Station selector buttons (5) - OFF
3. Delivery mode selector knob - OFF
   Placing the delivery mode selector knob to OFF removes power from the bombing timers.

CENTERLINE WEAPON RELEASE (DCU-94/A) (F-4D THRU BLK 33)

Before Bomb Run

1. Delivery mode selector knob - DIRECT or AS REQUIRED
2. Optical sight - SET (if required)
3. (P) Nuclear store consent switch - REL/ARM
4. DCU-94/A CL station selector switch - FORWARD
5. Arm nose tail switch - ARM

Bomb Run

1. DCU-94/A master release lock switch - FORWARD
   a. CL UNLOCKED light - ON
2. Master arm switch - ARM
   The master arm switch allows power to the arm nose tail switch.
3. Delivery maneuver - EXECUTE
   If the DIRECT delivery mode is selected, the bomb is released when the bomb button is depressed.

Note

If the bomb does not release, recheck switch positions, select the DIRECT release mode and depress bomb button, or energize the nuclear store jettison control.

POST STRIKE

Before Landing

1. Master arm switch - SAFE
2. Station selector knob - OFF
3. Gun & stores switch - NORMAL
4. Sight mode selector knob - STBY, or CAGE
5. All DCU-94/A station selector switches (5) - AFT
6. Missile arm switch - SAFE
7. Missile power switch - OFF
8. Missile jett knob - OFF

Armament Area (De-arming)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

ROCKETS (F-4D)

PREFLIGHT

Refer to part 4, figure 2-22.

INFLIGHT

ROCKET FIRING

1. Sight mode selector knob - A/G
2. Reticle depression knob - SET
3. Delivery mode selector knob - DIRECT
4. Weapon selector knob - RKTS & DISP/SINGLE
5. Station select - LOADED STATION
   a. Green light - ON
6. Master arm switch - ARM
   a. Amber light - ON
7. Bomb button - DEPRESS

LAUNCHER RELEASE

1. Delivery mode selector knob - DIRECT
2. Weapon selector knob - BOMBS/RIPPLE
3. Repeat above steps 5, 6, and 7, hold bomb button depressed 4 sec.
   a. When station is empty, amber light - OFF

If all launchers do not release:

4. Weapon selector knob - RKTS & DISP
5. Weapon selector knob - BOMBS/RIPPLE
6. Bomb button - DEPRESS (Hold 4 seconds)

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select - OFF
3. Gun & stores switch - NORMAL
4. Sight mode selector knob - STBY or CAGE
5. All DCU-94/A station selector switches (5) - AFT
6. Missile arm switch - SAFE
7. Missile power switch - OFF
8. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

CBU AND FLARE DISPENSERS (F-4D)

PREFLIGHT

Refer to part 4, figure 2-23.

INFLIGHT

DIRECT DELIVERY MODE

Dispensing

1. Delivery mode selector knob - DIRECT
2. Sight mode selector knob - A/G
3. Reticle depression knob - SET
4. Weapon selector knob - RKTS & DISP
   a. (SUU-13, -38, -42) Weapon selector knob - RKTS & DISP/SINGLE
5. (SUU-7) Intrvl switch - SET (if required)
6. Station select - LOADED STATIONS
   a. Green light - ON
7. Master arm switch - ARM
   a. Amber light - ON
8. Bomb button - DEPRESS AND HOLD
9. (SUU-7) CBU lights - MONITOR
   a. Blinking light - Tubes Remaining
   b. Amber light out - All tubes have received a firing pulse.

Note

The CBU lights will not monitor the empty status of the flare dispenser, SUU-13, SUU-38, SUU-42.

Dispenser Release

1. Delivery mode selector knob - DIRECT
2. Weapon selector knob - BOMBS/RIPPLE
3. Repeat above steps 6 thru 9, hold bomb button depressed 4 seconds.

If all dispensers do not release:

4. Weapon selector knob - RKTS & DISP
5. Weapon selector knob - BOMBS/RIPPLE
6. Bomb button - DEPRESS (Hold 4 seconds)

DIVE LAYDOWN

Before Bomb Run

1. Delivery mode selector knob - DIVE LAY
2. Sight mode selector knob - A/G
   The sight reticle is electrically caged to the radar boresight line and is drift stabilized.
3. HSI mode switches - NAV COMP
   If the HSI indications are to be used, the NAV COMP position must be selected.
4. (P) INS mode selector knob - NAV
5. (P) Radar mode selector knob - AIR-GND
6. (P) Radar range - R1
7. (P) Radar power - OPR
   B-sweep, acquisition symbol, and el strobe centered on scope.
8. (P) Antenna stab switch - NOR
9. (P) WRCS release range counter - SET
   Set the bomb range from release to impact.
10. (P) WRCS release advance - SET (if required)
11. (P) Range switch - NORM or X100
12. Weapon selector knob - RKTS & DISP
    a. (SUU-13, -38, -42) Weapon selector knob - RKTS & DISP/SINGLE
13. (SUU-7) Intrvl switch - SET (if required)

Note

The optical sight and the radar antenna is drift stabilized. Upwind correction must be made for the wind effect on the high drag bombs. Wind correction is not required for the low drag bombs (M117 GP, etc.).

14. Station selector button(s) - PUSH ON
    a. Green light(s) - ON
15. Master arm switch - ARM
    a. Amber light(s) - ON

Bomb Run

1. (P) Receiver gain - MINIMUM
2. (P) Lockon target
3. Bomb release button - DEPRESS AND HOLD
4. (SUU-7) CBU lights - MONITOR
   a. Blinking light - Tubes remaining
   b. Amber light out - All tubes have received a firing pulse.

Note

- The CBU lights will not monitor the empty status of the flare dispenser, SUU-13, SUU-38.
- During the initial dive toward the target area, the pilot reduces the receiver gain to obtain a single return, depress the action switch to Half-Action, place the range strobe in the center of the return, and then depress the action switch to Full-Action and release. After lockon, the AC places the pipper on target, depresses and holds the bomb release button, and initiates the desired delivery maneuver. After the bomb is automatically released, the pullup light will illuminate and will go out when the bomb button is released.

LAYDOWN

Before Bomb Run

1. Delivery mode selector knob - LAYDOWN
2. Sight mode selector knob - A/G
3. Reticle depression counter - SET (if required)
   Set the IP-to-target sight setting.
4. HSI mode switches - NAV COMP
   If the HSI steering information is to be used, the NAV COMP position must be selected.

5. (P) INS mode selector knob - NAV
6. (P) WRCS target range counter - SET
   Set the distance from IP to target.
7. (P) WRCS release range counter - SET
   Set the bomb range from release to impact.
8. (P) WRCS release advance counter - SET (if required)
9. Range switch - NORM or X100
10. Weapon selector knob - RKTS & DISP
    a. (SUU-13, -38, -42) Weapon selector knob - RKTS & DISP/SINGLE
11. (SUU-7) Intrvl switch - SET (if required)
12. Station selector button(s) - PUSH ON
    a. Green light - ON
13. Master arm switch - ARM
    a. Amber light - ON

Bomb Run

Approach the target at the preplanned release altitude and airspeed. When the aircraft is directly over the IP, or when the pipper is on target, depress and hold the bomb release button. Maintain a constant airspeed, altitude, and course until the bomb is automatically released. The pullup light will illuminate to indicate bomb release and will go out when the bomb button is released. Wind corrections for the bomb must be applied prior to depressing the bomb button.

1. Bomb release button - DEPRESS AND HOLD
2. (SUU-7) CBU lights - MONITOR
   a. Blinking light - Tubes Remaining
   b. Amber light out - All tubes have received a firing pulse.

Note

The CBU lights will not monitor the empty status of the flare dispenser, SUU-13, SUU-38, SUU-42.

OFFSET BOMBING/TARGET FIND

Before IP

1. Delivery mode selector knob - OFFSET BOMB or TGT FIND
2. Sight mode selector knob - A/G
   The optical sight reticle is electrically caged to the RBL and to 0° in azimuth. The roll tabs display aircraft attitude until target insert, then steering commands to the target.
3. Navigation mode selector knob - NAV COMP
4. HSI mode switches - NAV COMP
   If the HSI indications are to be used, the NAV COMP position must be selected.
5. (P) INS mode selector knob - NAV
6. (P) BDHI mode switch - NAV COMP
7. (P) Weapon delivery panel - SET
   a. Activate switch - NORMAL
   b. Tgt find switch - NORMAL
   c. Range switch - AS REQUIRED
8. (P) WRCS input counters - SET
   a. Target distance N/S - 100-ft increments
   b. Target distance E/W - 100-ft increments
   c. IP altitude MSL - 100-ft increments
   d. Release range - 10-ft or 100-ft increments (Offset bomb)
   e. Release advance - Milliseconds (Offset bomb, if required)
9. Weapon selector knob - RKTS & DISP (Offset bomb)
   a. (SUU-13, -38, -42) Weapon selector knob - RKTS & DISP/SINGLE
10. (SUU-7) Intrvl switch - SET (if required)

Note

The ADI will not provide steering if the weapon selector knob is on AGM-45.

11. Station selector button(s) - PUSH ON
    a. Green light - ON
12. Master arm switch - ARM
    a. Amber light - ON

Bomb Run-Offset Radar IP

1. (P) Radar power - OPR
2. (P) Radar mode switch - MAP-PPI
3. (P) Antenna stab switch - NOR
4. (P) Cursor intensity - ADJUST
5. (P) Antenna elevation - ADJUST
6. (P) Scan switch - WIDE
7. (P) Radar range selector knob - R1
8. (P) Operate the along track cursor to position the range cursor over the RIP.
9. (P) Operate the cross track cursor to position the offset cursor over the RIP.
10. (P) Freeze button - PUSH ON

Note

- The along track cursor must be moved first to initiate cursor control. Position the intersection of the cursors over the RIP and then push the freeze button ON: the cursors begin tracking the RIP. The cursors can be moved to touch-up the intersection location over the RIP after the Freeze button is pushed on.

- Do not position the range cursor below zero range. If the range cursor is moved below zero range and then moved out over the IP, the steering information will be in error by 180° even though the cursor responds normally to along track cursor control movements.

11. (P) Target insert button - PUSH ON
    The steering instruments display steering commands when the target insert button is pushed ON, and the cursor intersection will position over the target location and track the target. If the target is on the scope, set the target elevation on the ALT RANGE counter and touch-up the cursors over the target.
12. Bomb release button - DEPRESS AND HOLD (Offset Bomb)

13. (SUU-7) CBU lights - MONITOR
    a. Blinking light - Tubes Remaining
    b. Amber light out - All tubes have received a firing pulse.

    When the aircraft is on course to the target and at the preplanned release altitude and airspeed, depress and hold the bomb release button until the bomb is released, as indicated by illumination of the pullup light.

Note

The roll tabs rotate as the target is passed, and the BDHI and HSI distance-to-target counters will approach zero and then start increasing in value.

Note

The CBU lights will not monitor the empty status of the flare dispenser, SUU-13, SUU-38, SUU-42.

Bomb Run-Visual IP Fly-Over

1. (P) When over IP, freeze button and target insert button - PUSH ON

   When the aircraft is directly over the IP, the freeze button and the target insert button are pushed ON simultaneously. The steering instruments supply steering commands to the target, and the cursors will position over, and start tracking the target. If the target is visible on the scope, the pilot may touch-up the cursors when the target elevation is set in the ALT RANGE control.
2. Bomb release button - DEPRESS AND HOLD (Offset Bomb)
3. (SUU-7) CBU lights - MONITOR
   a. Blinking light - Tubes Remaining
   b. Amber light out - All tubes have received a firing pulse.

   When the aircraft is on course to the target and at the preplanned release altitude and true airspeed, depress and hold the bomb release button until bomb release occurs, indicated by the illumination of the pullup light.

Note

The roll tabs rotate as the target is passed, and the BDHI and HSI distance-to-target counters will approach zero and then start increasing in value.

POST STRIKE

Before Landing

1. Master arm switch - SAFE
2. Station select - OFF
3. Gun & stores switch - NORMAL
4. Sight mode selector knob - STBY, or CAGE
5. All DCU-94/A station selector switches (5) - AFT
6. Missile arm switch - SAFE
7. Missile power switch - OFF
8. Missile jett knob - OFF

Armament Area (De-arming)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

A/B 45Y-1, Y-2, Y-4 SPRAY TANK DISPENSERS (F-4D)

PREFLIGHT

Refer to part 4, figure 2-24.

INFLIGHT

DISPENSING

1. Delivery mode selector knob - DIRECT
2. Weapon selector knob - RKTS & DISP, SINGLE
3. Station select - LOADED STATIONS
   a. Green light - ON
4. Arm nose tail switch - NOSE & TAIL
5. Master arm switch - ARM
   a. Amber light - ON

Note

Placing the master arm switch to ARM arms the A/B 45Y-1 tank causing an explosive squib to discharge, thereby pressurizing the bladder of liquid.

WARNING

Once the A/B 45Y-1 is armed, it cannot be de-armed and therefore must not be brought back to base.

Note

- On the A/B 45Y-2 dry agent spray tank, energizing the master arm switch causes the agent container to be pressurized by ram air for proper dissemination. The Y-2 tank can be de-armed by positioning the master arm switch to SAFE.
- On the A/B 45Y-4 dry agent spray tank, energizing the master arm switch arms the tank. The Y-4 tank can be de-armed by positioning the master arm switch to SAFE.

6. Bomb button - DEPRESSED
7. Amber light - MONITOR
   a. Blinking amber light - spray remaining
   b. Amber light out - no spray remaining

DISPENSER RELEASE

1. Wing tank jettison switch - JETT

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select - OFF
3. Guns & store switch - NORMAL
4. Slight mode selector knob - STBY, or CAGE
5. All DCU-94/A station selector switches (5) - AFT
6. Missile arm switch - SAFE
7. Missile power switch - OFF
8. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

TMU-28/B SPRAY TANK (F-4D)

PREFLIGHT

Refer to part 4, figure 2-24.

INFLIGHT

1. Weapon selector knob - A/G MISSILE (Not in RKTS & DISP)
2. Arm nose tail switch - SAFE
3. Master arm switch - SAFE

DISPENSING

1. Station selector button(s) - SELECT LOADED STATION(S)
   a. Green light(s) - ON
2. Master arm switch - ARM
   a. Amber light(s) remain - OFF
3. To extend boom, weapon selector knob - RKTS & DISP/SINGLE
   a. While boom is extending, amber light(s) - ON STEADY
   b. Boom fully extended, amber light(s) - BLINKING
4. To begin dispensing, bomb button - DEPRESS AND HOLD (8 sec)
5. To stop dispensing, bomb button - RELEASE
6. Weapon selector knob - A/G MISSILE (Not in RKTS & DISP)
7. To retract boom, arm nose tail switch - NOSE & TAIL
   a. Amber light continues to blink after boom is retracted.

Note

The amber light will continue to blink until power is removed from the aircraft, except when the station selector button is pushed off. When the station selector button is pushed on, the light will begin blinking again.

8. Station selector button(s) - PUSH OFF
   a. Green and amber lights - OFF

DISPENSER RELEASE

1. Wing/Tank jettison switch - JETT

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select - OFF
3. Guns & store switch - NORMAL
4. Sight mode selector knob - STBY, or CAGE
5. All DCU-94/A station selector switches (5) - AFT
6. Missile arm switch - SAFE
7. Missile power switch - OFF
8. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

PAU-7/A SPRAY TANK (F-4D)

PREFLIGHT

Refer to part 4, Cockpit Weapons Check and Exterior Inspection (Spray Tanks A/B45Y-1, -2, -4, PAU-7/A, TMU-28/B)

INFLIGHT

1. Weapon selector knob - A/G MISSILE (NOT RKTS & DISP)
2. Arm nose tail switch - SAFE
3. Master arm switch - SAFE

DISPENSING

1. Station selector buttons - RO, LO, OR BOTH AS REQUIRED
   a. Green select light(s) - ON
2. Weapon selector knob - RKTS & DISP/SINGLE
3. Bomb mode selector knob - DIRECT
4. Master arm switch - ARM
5. To extend boom arm nose tail switch - NOSE & TAIL
6. To dispense, bomb button - DEPRESS & HOLD
   Tank will dispense with boom up or down.
7. To stop dispensing, bomb button - RELEASE
8. To retract boom, arm nose tail switch - TAIL (90 sec)
9. Station selector button(s) - PUSH OFF (after boom retract)
   a. Green light(s) - OFF
10. Delivery mode select knob - OFF

DISPENSER RELEASE

1. Wing tank jettison switch - JETT

BEFORE LANDING

1. Master arm switch - SAFE
2. Station selector button(s) - OFF
3. Guns & store switch - NORMAL
4. Sight mode selector knob - STBY, or CAGE
5. All DCU-94/A station selector switches (5) - AFT
6. Missile arm switch - SAFE
7. Missile power switch - OFF
8. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

SUU-16/A, -23/A GUN POD (F-4D)

PREFLIGHT

Refer to part 4, Cockpit Weapons Check and Exterior Inspection (SUU-16/A-23/A Gun Pod)

INFLIGHT

STRAFING

1. Sight mode selector knob - A/G
2. Reticle depression counter - SET

Note

- If the optical sight is to be used, the OFF or DIRECT position should be selected on the delivery mode selector panel.
- Reference to the RAT (ram air turbine) is applicable to the SUU-16/A gun pod only.

3. Gun clear switch - NONCLEAR or AUTO CLEAR
4. Weapon selector knob - GUNS or AS REQUIRED
   When BOMBS or RKTS & DISP are selected, the guns and stores switch must be in guns and stores to select the guns.
5. Guns and stores switch - NORMAL or GUNS & STORES
   When the weapon selector knob is positioned to GUNS, the switch should be in NORMAL.
6. Station selector button(s) - PUSH ON
   a. Green light(s) - ON (SUU-23 Prestart)
7. Master arm switch - ARM
   a. Amber light(s) - ON, RAT OUT (SUU-16)
      The RAT will extend when the master arm switch is placed to ARM.
8. Trigger switch - ACTUATE

AIR-TO-AIR

1. Sight mode selector knob - A/A
2. Gun clear switch - NONCLEAR or AUTO CLEAR
3. Weapon selector knob - GUNS or AS REQUIRED
4. Guns and stores switch - NORMAL or GUNS & STORES
5. Station selector button(s) - PUSH ON
   a. Green light(s) - ON (SUU-23 Prestart)
6. (P) Radar power - OPR
7. (P) Radar mode switch - AS REQUIRED
8. (P) Radar range - R1
9. Master arm switch - ARM
   a. Amber light(s) - ON, RAT OUT (SUU-16)
      The RAT will extend when the master arm switch placed to ARM.
10. (P) Target lock-on - ACCOMPLISH
11. Trigger switch - ACTUATE

FINAL BURST SAFE GUNS (Rounds Remaining)

1. Gun clear switch - AUTO CLEAR
2. Trigger switch - ACTUATE
3. Station selector button - PUSH OFF
   a. Green light - OFF.
   b. Amber light - OFF, RAT IN
      The RAT will retract when the station selector button is pushed OFF.
4. Guns and stores switch - NORMAL
5. Master arm switch - SAFE

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select - OFF
3. Guns & stores switch - NORMAL
4. Sight mode selector knob - STBY or CAGE
5. All DCU-94/A station selector switches (5) - AFT
6. Missile arm switch - SAFE
7. Missile power - OFF
8. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

AGM-12B/C/E MISSILE (F-4D)

PREFLIGHT

Refer to part 4, figures 2-20A and 2-26.

INFLIGHT

TRANSMITTER CHECK

Perform an airborne check as follows:

1. Delivery mode select knob - DIRECT
2. Station selector buttons - OFF
   a. Green lights - OFF
3. Warning lights test sw - TEST
   a. Station green and amber lights - ON
4. Weapon selector knob - AGM-12
5. Master arm switch - ARM
   a. All station amber lights - OFF
6. Bomb button - DEPRESS
7. Control handle - TRANSMIT COMMANDS
   The transmitter timer is energized for 50 ± 10 seconds.
8. Master arm switch - SAFE

BEFORE MISSILE LAUNCH

1. (AC, P) Oxygen diluter selector - 100 PERCENT
2. Weapon selector knob - AGM-12
3. Station selector button - DEPRESS
   a. Green light - ON

MISSILE LAUNCH

1. Master arm switch - ARM
   a. Station amber light - ON
2. Bomb button - DEPRESS (2 sec approx)
   Depress and hold the bomb button until the missile fires or until the launch is aborted due to missile malfunction.

To immediately arm a second missile for re-attack:

3. Station selector button (just fired) - DEPRESS
   a. Green light - OFF
4. Station selector button (next missile) - DEPRESS
   a. Green light - ON
   b. Amber light - ON

MISSILE FLIGHT (AGM-12E)

To prevent AGM-12E warhead from functioning:

1. (P) Armament power circuit breaker - PULL (6E, No. 2 panel)
   If it is necessary to safe the missile, pull circuit breaker 6E.

AFTER MISSILE ATTACK

1. Armament switches - OFF/SAFE
   a. Master arm switch - SAFE
   b. Station selector buttons - OFF
2. Emergency vent handle - CYCLE
   Pull to de-pressurize, then push to pressurize to cycle cockpit air in case of contamination by missile exhaust gases.

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select - OFF
3. Guns & stores switch - NORMAL
4. Sight mode selector knob - STBY, or CAGE
5. All DCU-94/A station selector switches (5) - AFT
6. Missile arm switch - SAFE
7. Missile power switch - OFF
8. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

SUU-20 BOMB/ROCKET DISPENSERS (F-4D)

PREFLIGHT

Refer to Cockpit Weapons Check and Exterior Inspection, part 4

INFLIGHT

ROCKET DELIVERY

1. Sight mode selector knob - A/G
2. Reticle depression knob - SET
3. Delivery mode selector knob - DIRECT
4. Intrvl switch - .10 OR .14 ONLY
5. Station select - AS REQUIRED
   a. Green light - ON
6. Weapon selector knob - RKTS & DISP
7. Master arm switch - ARM
   a. Amber light - ON

BOMB DELIVERY

1. Sight mode selector knob - A/G
2. Reticle depression knob - SET
3. Delivery mode selector knob - AS REQUIRED
4. Intrvl switch - .10 OR .14
5. Station select - AS REQUIRED
   a. Green light - ON
6. Weapon selector knob - BOMBS/SINGLE/RIPPLE/TRIPLE
7. Master arm switch - ARM
   a. Amber light - ON

Note

- There is no cockpit indication to determine that all bombs or rockets have been released or fired.
- The intervalometers within the SUU-20 cannot be rehomed in flight for an attempt to release or fire a hung bomb or rocket.
- Do not use an aircraft interval setting of 0.06.

BEFORE LANDING

1. Master arm switch - SAFE
2. Stations select - OFF
3. Guns & stores switch - NORMAL
4. Sight mode selector knob - STBY, or CAGE
5. All DCU-94/A station selector switches (5) - AFT
6. Missile arm switch - SAFE
7. Missile power switch - OFF
8. Missile jett knob - OFF

ARMAMENT AREA (DEARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

SUU-21/A BOMB DISPENSER (F-4D)

PREFLIGHT

Refer to part 4, cockpit weapons check and Exterior Inspection (SUU-21/A) -

INTERIOR INSPECTION (DCU-94/A)

Before applying external power:

1. All station select switches (5) - AFT
2. Station select switch guard - INSTALLED
   If other munitions are aboard, the required guard should be installed.
3. Master release lock switch - AFT
4. Option selector knob - OFF
5. Bomb mode select knob - OFF
6. (WSO) Nuclear store consent switch - SAFE

With the dispenser doors open, proceed as follows:

7. External power - APPLY
8. Generator switches - EXT ON
9. Lamp test button - PRESS
   a. Warn and unlocked lights - ON
10. Option selector knob - SAFE
    a. Loaded station warn light(s) - FLASHING (doors closing)
    b. Loaded station warn light(s) - OFF (doors closed)
11. Option selector knob - OFF

INFLIGHT

ON BOMB RANGE (DCU-94/A)

1. Option selector knob - SAFE
2. Loaded station selector switch - FORWARD
   a. Loaded station WARN light - ON
3. (WSO) Nuclear store consent switch - REL/ARM
   a. Loaded station WARN light - OFF
4. Option selector knob - GRD
   a. Loaded station WARN light - FLASHING (doors opening)
   b. Loaded station WARN light - ON (doors open)
5. Delivery mode selector knob - AS REQUIRED
6. Weapon selector knob - NOT RKTS & DISP

Note

When the SUU-21/A dispenser is loaded on the inboard stations bomb release will not occur if the weapon selector knob is on RKTS & DISP.

BEFORE BOMB RUN (DCU-94/A)

1. Master release lock switch - FORWARD
   a. Loaded station UNLOCKED light - ON
2. Loaded station WARN light - ON

AFTER BOMB RELEASE (DCU-94/A)

Manual Operation

After each bomb release, the dispenser doors remain open and additional switching procedures are unnecessary. With the DIRECT bombing mode selected, the release system (pickle button) is hot. If it is necessary to safe the system between runs, place the master release lock switch AFT, and reselect FWD just prior to the next run.

Automatic Operation

1. At bomb release loaded station WARN light - FLASHING
2. Loaded station WARN light - OFF (doors closed)
3. Option selector knob - SAFE
4. Option selector knob - GRD
   a. Loaded station WARN light - FLASHING
   b. Loaded station WARN light - ON (doors open)

AFTER FINAL BOMB RELEASE (DCU-94/A)

1. (Auto mode) Loaded station WARN light - FLASHING
2. (Auto mode) Loaded station WARN light - OFF (doors closed)
3. Option selector knob - SAFE
   a. (Man. mode) Loaded station WARN light - FLASHING
   b. (Man. mode) Loaded station WARN light - OFF (doors closed)
4. Master release lock switch - AFT
   a. Loaded station UNLOCKED light - OFF
5. Delivery mode selector knob - OFF

WARNING

If the dispenser doors do not close and all bombs have not been expended, the aircraft must be flown to avoid populated areas to the greatest degree practicable.

AFTER LANDING (DCU-94/A)

To open dispenser doors, if required:

1. (P) Nuclear store consent switch - REL/ARM
2. Loaded station selector switch - FORWARD
3. Option selector knob - GRD
   a. Loaded station WARN light - FLASHING
   b. Loaded station WARN light - ON (doors open)
4. All electrical power - REMOVED

Note

All electrical power must be removed from the aircraft before performing steps 5, 6 and 7 to preclude the dispenser doors from closing.

5. Option selector knob - OFF
6. All station selector switches (5) - AFT
7. (P) Nuclear store consent switch - SAFE

SUU-21/A BOMB DISPENSER (MODIFIED)(F-4D)

PREFLIGHT

These procedures consider the employment of SUU-21/A dispensers modified for use with pedestal panel controls and inboard (sta 2 and 8) carriage only.

Refer to part 4, Cockpit Weapons Check and Exterior Inspection (SUU-21/A Dispenser).

INTERIOR INSPECTION

If the dispenser doors are open, close the doors as follows:

1. External power - APPLY
2. Generator switches - EXT ON
3. Armament safety override - DEPRESS
4. Station select button(s) - DEPRESS
   a. Station green light(s) - ON
5. Master arm switch - ARM
   a. Station amber light(s) - ON
6. Arm nose tail switch - NOSE
   a. Station amber light(s) - FLASHING (doors closing)
   b. Station amber light(s) - OFF (doors closed)
7. Station select button(s) - OFF
8. Master arm switch - SAFE

INFLIGHT

WEAPON RELEASE

1. Optical sight - SET
   a. Mode selector - A/G
   b. Reticle depression knob - SET AS REQUIRED
2. Delivery mode selector knob - AS REQUIRED
3. Weapon selector knob - BOMBS

4. Station select button(s) - DEPRESS
5. Master arm switch - ARM
   a. Amber light(s) - ON
6. Arm nose tail switch - N&T
   a. Station amber light - FLASHING (doors opening)
   b. Station amber light - ON (doors open)
7. Bomb button - DEPRESS

AFTER FINAL BOMB RELEASE

1. Arm nose tail switch - NOSE
   a. Station amber light - FLASHING (doors closing)
   b. Station amber light - OUT (doors closed)
2. Master arm switch - SAFE
3. Station select - OFF
4. Delivery mode selector knob - OFF
5. Sight mode selector knob - STBY or CAGE

AFTER LANDING

To open SUU-21/A Dispenser Doors:

1. Armament safety override button - DEPRESS
2. Station select button(s) - DEPRESS
3. Master arm switch - ON
4. Arm nose tail switch - N&T
   a. Station amber light(s) - FLASHING (doors opening)
   b. Station amber light(s) - ON (doors open)
5. Station select button(s) - OFF
6. Master arm switch - OFF

TDU-11/B TARGET ROCKET (5-INCH HVAR) (F-4D)

PREFLIGHT

Refer to part 4.

INFLIGHT

1. Optical sight - SET AS DESIRED
2. Missile select switch - HEAT
3. Applicable SW light - ON
   If the SW light indicates that the station containing the target rocket is not selected, actuate the missile select switch to HEAT REJECT until the desired station is selected.
4. Missile arm switch - ARM
   a. READY light - ON
5. Trigger switch - ACTUATE
   After the target rocket is fired, maneuver the aircraft to pursue the target rocket, monitor the aural tone in the head set, and prepare to launch the AIM-9B missile at the target rocket. Prior to launching the AIM-9B missile, observe proper SW and READY light indications, aircraft to target range, and proper tone indication.

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select - OFF
3. Gun & stores switch - NORMAL
4. Sight mode selector knob - STBY, or CAGE
5. All DCU-94/A station selector switches (5) - AFT
6. Missile arm switch - SAFE
7. Missile power switch - OFF
8. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING).

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

MODIFIED A/A 37U-15 TOW TARGET SYSTEM (F-4D)

PREFLIGHT

Refer to part 4.

INFLIGHT

PRE-TAKEOFF

To reduce rolling tendencies immediately after takeoff, the following aileron trim positions are recommended. Trim settings are the same with or without centerline tank.

a. Dart system on station 1, station 9 empty: 2.5 inches left aileron down (trim 2.5 seconds to right of neutral), 1.5 inches right rudder (trim 1.5 seconds to right of neutral).
b. Dart system or station 1, external fuel tank on station 9: 3.5 inches right aileron down (trim 3.5 seconds to left of neutral), 1.0 inch left rudder (trim 1.0 second to left of neutral).

Note

The tow target system, carried on the left outboard wing station, may induce 20° to 30° errors in the remote compass transmitter. Due to this effect, the DG mode on the compass controller should be selected.

TAKEOFF

Initiate a slow pitch rotation at 140 KIAS to obtain 8° pitch attitude indicated on the ADI for liftoff at 180 to 190 KIAS. Decrease thrust after gear and flap retraction to ensure that 275 KIAS is not exceeded.

Note

Refer to T.O. 1F-4C-1 External Store Limitations for A/A 37U-15 Tow Target System inflight limitations.

TARGET DEPLOYMENT

1. Select DG mode on compass controller.
2. Delivery mode selector knob - DIRECT
3. Weapon selector knob - BOMBS/SINGLE
4. Station select - LO
   a. Green light - ON
5. Arm nose tail switch - SAFE
6. Master arm switch - ARM
   a. Amber light - ON
7. Bomb button - DEPRESS
   Depressing the bomb button once will launch the target.

CAUTION

Do not attempt to deploy a damaged dart target. Motion of the damaged target after release is unpredictable. Possible contact with the aircraft could be hazardous.

8. Master arm switch - SAFE
   a. Amber light - OFF
      The master arm switch should be on SAFE to preclude inadvertent cable cut.

CABLE CUT

1. Master arm switch - ARM
   a. Amber light - ON
2. Tow cable - CUT
   a. (before Rev K) Bomb button - DEPRESS
   b. (after Rev K) Arm nose tail switch - NOSE
3. Chase plane, acknowledge cable cut.

Emergency Cut

1. Arm nose tail switch - NOSE & TAIL or TAIL
2. Chase plane, acknowledge cable cut.

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select - OFF
3. Gun & store switch - NORMAL
4. Sight mode selector knob - STBY or CAGE
5. All DCU-94/A station selector switches (5) - AFT
6. Missile arm switch - SAFE
7. Missile power switch - OFF
8. Missile jett knob - OFF

LANDING WITH STOWED TARGET (DAMAGED OR UNDAMAGED)

1. Flaps - 1/2
2. Angle of attack - 17 to 18 UNITS
   (With wing tank use less than 17 units)

INFLIGHT PROCEDURES FOR BOMBING RANGE SELECTED WEAPONS (F-4D)

These procedures are included for easy inflight reference to support typical bombing, rocket, and strafe missions on the bomb range. Aircrews are still required to use appropriate checklists for preflight and jettison operations. Only the numbered items need be performed; sub-steps are added for clarity.

INFLIGHT

ROCKET LAUNCHERS AND SUU-20

1. Sight mode selector knob - A/G
2. Reticle depression knob - SET
3. Delivery mode selector knob - AS REQUIRED
4. Intrvl switch - .10 OR .14
5. Station select - AS REQUIRED
   a. Green light - ON
6. Weapon selector knob - BOMBS/SINGLE/RIPPLE/TRIPLE
7. Master arm switch - ARM
   a. Amber light - ON

BOMBS, SUU-20

1. Sight mode selector knob - A/G
2. Reticle depression knob - SET
3. Delivery mode selector knob - DIRECT
4. Intrvl switch - .10 OR .14 ONLY
5. Station select - AS REQUIRED
   a. Green light - ON
6. Weapon selector knob - RKTS & DISP
7. Master arm switch - ARM
   a. Amber light - ON

BOMBS, SUU-21/A (DCU-94/A)

1. Sight mode selector knob - A/G
2. Reticle depression knob - SET
3. Delivery mode selector knob - AS REQUIRED
4. Weapon selector knob - BOMBS
5. Option selector knob - SAFE
6. Loaded station selector switch - FORWARD
   a. WARN light - ON
7. (WSO) Nuclear consent switch - REL/ARM
   a. WARN light - OFF
8. Option selector knob - GRD
   a. WARN light - FLASH
   b. WARN light - ON
9. Master release lock switch - FORWARD
   a. UNLOCKED light - ON

Note

To reopen doors during automatic operation, repeat steps 5 and 8.

After Final Release (DCU-94/A)

1. Option selector knob - SAFE
   a. WARN light - FLASH/OFF
2. Master release lock switch - AFT
   a. UNLOCKED light - OFF
3. Loaded station selector switch - AFT
4. (WSO) Nuclear consent switch - SAFE

BOMBS, SUU-21/A MODIFIED

1. Sight mode selector knob - A/G
2. Reticle depression knob - SET
3. Delivery mode selector knob - AS REQUIRED
4. Weapon selector knob - BOMBS
5. Station select button(s) - DEPRESS
6. Master arm switch - ARM
   a. Amber light(s) - ON
7. Arm nose tail switch - N&T
   a. Station amber light(s) - FLASHING (doors opening)
   b. Station amber light(s) - ON (doors open)

To Close Doors

1. Arm nose tail switch - NOSE
   a. Amber light - FLASHING, THEN OFF

STRAFE - SUU-16/A, 23/A, and M61A NOSE GUN

1. Sight mode selector knob - A/G
2. Reticle depression knob - SET
3. Delivery mode selector knob - OFF/DIRECT
4. Station select - AS REQUIRED
   a. Green light - ON
5. Weapon selector knob - GUNS/AS REQUIRED
6. Gun clear switch - AS REQUIRED
7. Guns and stores switch - AS REQUIRED
8. Master arm switch - ARM
   a. Amber light - ON

RANGE DEPARTURE

1. Sight mode selector knob - CAGED, STBY
2. Delivery mode selector knob - OFF
3. Station select - OFF
4. Master arm switch - SAFE

"All data on pages 2-49 thru 2-62 including figures 2-9 thru 2-13 deleted."

PART 3 NORMAL AIRCREW PROCEDURES F-4E

TABLE OF CONTENTS

OPTICAL SIGHT CHECK (F-4E)

During the following procedures, the AC has the option of using the BIT masks or noting the position of the pipper on the ground to determine the magnitude of reticle movement. Prior to selecting BIT 1, the AC should position his head to the right until one-half of the reticle is removed by the BIT 1 mask. The BIT 2 mask must be rotated forward to remove the top half of the reticle prior to selecting BIT 2. Radar power must be available at least 30 seconds prior to performing the BIT 2 check. For proper BIT check, a 10-Mil sight depression must be used.

CAUTION

To avoid gyro system damage and to get an accurate BIT check, gunsight BIT checks should be performed only when the aircraft is stopped or in level unaccelerated flight.

1. Sight mode selector knob - STBY (Remain for 30 sec)
   The sight mode switch should remain in STBY for 30 seconds to provide warmup power prior to selecting other modes; however, this will not damage the set if not accomplished.
2. (WSO) Radar power - TEST or STBY

CAUTION

Radar power should remain in OFF until the aircraft is operating on internal power and the engines are up to 50% rpm minimum. This will reduce specific diode failures within the radar pulse transmitter and provide adequate cooling for radar components.

3. Sight shutter lever - OPEN
4. Sight mode selector knob - CAGE
   Reticle should appear on the combining glass.
5. Reticle intensity control - CHECK
   Check that the reticle intensity can be controlled.
6. Reticle depression counter - SET 10 MILS
7. Sight mode selector knob - CAGE to A/G to A/A
   a. Pipper at RBL, note position of pipper.
   b. Check ± 2 mils between modes.
   With the sight mode selector knob in CAGE, note the position of the pipper on the ground, then rotate the sight mode selector knob from CAGE to A/G, and then to A/A. There should not be more than 2 mils difference between the three positions. This is a radar boresight line (RBL).

Note

When the sight mode selector knob is positioned to CAGED, A/A, A/G, it remains caged to the radar boresight line regardless, of the reticle depression counter setting. This is true only when the aircraft is on the ground; when airborne, the sight functions normally.

8. Sight mode selector knob - BIT 1
   a. The reticle should jump 25 ± 4 mils horizontally to the left (figure 2-14).
   b. The roll tabs should rotate 90° clockwise.
   c. The range bar should indicate 4000 feet (3 o'clock position).

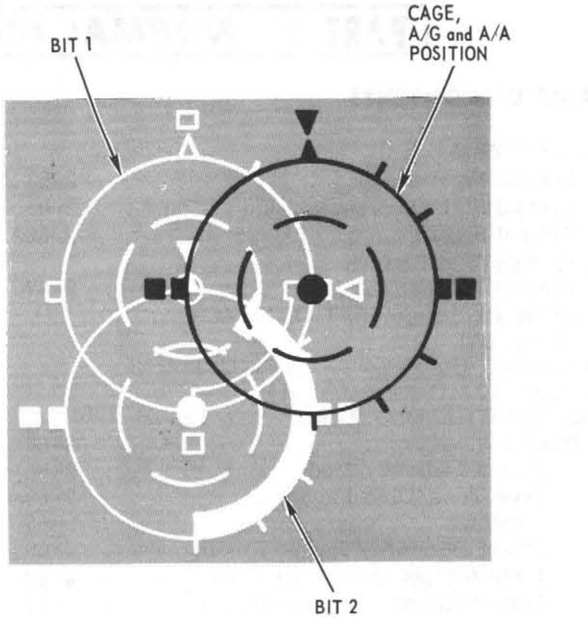
Note

A 30-second warm-up period is required prior to performing BIT 2.

9. Sight mode selector knob - BIT 2
   a. The reticle should jump 25 ± 4 mils down from the BIT 1 position (figure 2-17).
   b. The range bar should indicate 6700 feet (12:30 o'clock position).
   c. Roll tabs should indicate level flight.
10. Sight mode selector knob - A/A
   a. The pipper should return to the radar boresight line.

Optical Sight/Radar Tie-In (Before T.O. 1F-4E-540)

11. (AC) All armament switches - OFF/SAFE
   a. Station green/amber lights - OFF
   b. Weapon selector knob - BOMBS



Notes

a. 10 mils must be set into manual depression window for proper read-out of BIT functions.

b. Rear cockpit radar power switch must be out of "Off" position for at least 30 seconds.

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Figure 2-14

12. (AC) Armement safety override button - PUSH IN

WARNING

When the armament safety override button is energized, the jettison circuit is placed in an inflight configuration, regardless of the landing gear handle position. The AC has a jettison capability during takeoff while weight is on the gear.

13. (WSO) Radar range - R1
14. (WSO) Track switch - MANUAL
15. Radar mode selector knob - RDR
16. (WSO) Action switch HA, position gate at 2 NM and depress to FA.
   a. Range bar indicates 12,000 ft. (3 o'clock).
   b. (WSO) Display switch - VI
   c. VI meter reads greater than 9000 ft. (Range rate is selected by manual Vc knob.)
17. (AC-WSO) Rotate manual Vc knob to obtain 200 knots closure; range bar begins moving toward 5 o'clock (6000 ft.) position.
18. (AC) Master arm switch - ARM (at 6000 ft.)

Note

After T.O. 1F-4E-534, the lead compute mode may be obtained with master arm switch in SAFE.

19. (AC) Weapon selector knob - GUNS (at 6000 ft.)
    a. Range bar jumps to 1 o'clock.
    b. Reticle slowly depresses 4 to 5 mils.
20. (AC-WSO) Compare VI meter range readout and range bar as range decreases. Inside 4000 ft. (3 o'clock), the pipper rises 4 to 5 mils as range approaches 1500 feet. Stop the range bar at 1500 feet (Vc knob zero closure).
21. (AC) Reticle cage (ARR) button - DEPRESS AND HOLD
    a. Pipper should not move more than one mil.
22. (WSO) Action switch - HA and RELEASE
    a. Range bar - OFF
23. (AC) Reticle cage (ARR) button - RELEASE
    a. Pipper should not move more than one mil.
24. (AC) Master arm switch - SAFE
25. (AC) Sight mode selector knob - STBY or CAGE

CAUTION

The sight should be caged for takeoff and landing; select STBY or CAGE to prevent damage to the mirror drive assembly.

26. (AC) Shutter lever - OFF (if leaving airplane) If further use of the sight is not anticipated, close the shutter to prevent sun light from entering optical system.

Optical Sight/Radar Tie-In (After T.O. 1F-4E-540, Before T.O. 1F-4E-556)

11. (AC) All armament switches - OFF/SAFE
    a. Station green/amber lights - OFF
    b. Weapon selector knob - BOMBS
12. (AC) Armament safety override button - PUSH IN

WARNING

When the armament safety override button is energized, the jettison circuit is placed in an inflight configuration, regardless of the landing gear handle position.

13. (WSO) Radar power - TEST
14. (WSO) Test - 1
15. (WSO) Radar range - R1
16. (WSO) Track switch - AUTO
17. (WSO) Radar mode selector knob - RDR
18. (WSO) Action switch HA, position gate at first tgt and depress to FA.
    a. (AC) Range bar indicates 6000 ft. (5 o'clock).
    b. (AC) VI meter reads 6000 ft.
19. (AC) Weapon selector knob - GUNS
    a. Range bar jumps to 1 o'clock (6000 ft.). The sight switches out of triple ranging.
    b. Reticle slowly depresses 4 to 5 mils. The pipper is moving from RBL (missiles) to lead compute (guns).
20. (AC) Reticle cage (ARR) button - DEPRESS AND RELEASE
    a. Pipper moves up to 1500 range and returns to 6000 ft. range.
    b. Range bar continues to read 6000 ft. (1 o'clock)
21. (WSO) Action switch - HA and RELEASE
    a. (AC) Pipper moves from 6000 ft to 1500 ft. range.
    b. (AC) Range bar - OFF
22. (AC) Sight mode selector knob - STBY or CAGE

CAUTION

The sight should be caged for takeoff and landing: select STBY or CAGE to prevent damage to the servoed mirror and the gyro gimbals.

23. (AC) Shutter lever - CLOSE (if leaving airplane) If further use of the sight is not anticipated, close the shutter to prevent sun light from entering optical system.

Optical Sight/Radar Tie-In (After T.O. 1F-4E-556)

11. (AC) All armament switches - OFF/SAFE
    a. Station green/amber lights - OFF
    b. Heads up ARM light - OFF
    c. Weapon selector knob - BOMBS
12. (AC) Armament safety override button - PUSH IN

WARNING

When the armament safety override button is energized, the jettison circuit is placed in an inflight configuration, regardless of the landing gear handle position.

13. (AC) Guns/missile select - RADAR
    a. Heads up RADAR light - ON
14. (WSO) Radar power - TEST
15. (WSO) Test - 1
16. (WSO) Radar range - R1
17. (WSO) Track switch - AUTO
18. (WSO) Radar mode - BST
19. (AC) Auto-acq sw - DEPRESS and RELEASE
    a. Radar locks on first target.
    b. (AC) Range bar indicates 6000 ft. (5 o'clock).
    c. (AC) VI meter reads 6000 ft.
20. (AC) Guns/missiles sel - GUNS
    a. Heads up GUN light - ON

b. Range bar jumps to 1 o'clock (6000 ft.). The sight switches out of triple ranging.
c. Reticle slowly depresses 4 to 5 mils. The pipper is moving from RBL (missiles) to lead compute (guns).

21. (AC) Cage button - DEPRESS AND RELEASE
    a. Pipper moves up to 1000 range and returns to 6000 ft. range.
    b. Range bar continues to read 6000 ft. (1 o'clock)
22. (WSO) Action switch - HA and RELEASE
    a. Radar breaks lockon.
    b. (AC) Pipper moves from 6000 ft to 1000 ft. range.
    c. (AC) Range bar - OFF
23. (AC) Sight mode selector knob - STBY or CAGE

CAUTION

The sight should be caged for takeoff and landing: select STBY or CAGE to prevent damage to the mirror drive assembly.

24. (AC) Shutter lever - CLOSE (if leaving airplane)
    If further use of the sight is not anticipated, close the shutter to prevent sun light from entering optical system.

OPTICAL SIGHT MALFUNCTION INDICATIONS F-4E

ITEM	BIT MODE	MALFUNCTION	OPTICAL SIGHT STATUS
RETICLE ELEVATION	BIT 1	Reticle goes to +10 mils with -10 set in the manual depression control.	The manual depression CDX is functioning, but cannot be manually adjusted. Sight is useless for WRCS laydown, dive bombing, rockets, air-to-ground, and guns air to ground. Dive toss, dive laydown, missile and guns air-to-air and offset bombing modes are operational.
	BIT 2	Reticle remains at RBL.	There is either no effect, or all modes except WRCS laydown missiles and guns air-to-air, and offset bomb will be inoperative.
	BIT 1	Reticle drives to bottom of the combining glass.	All modes are inoperative.
	BIT 1	Reticle drives 35 mils to top of the combining glass.	WRCS laydown may be affected.
	BIT 2	Reticle drives down but not to 25 mils.	Correct lead angles are not being generated and lead computing operation is in error.
RETICLE AZIMUTH	BIT 1	Reticle remains at RBL.	The sight may remain at the RBL in all modes. It is also possible that the sight may not respond to drift signals applied to dive laydown WRCS laydown, or dive toss. However, lead computing operation is unaffected.
	BIT 1 and BIT 2	Reticle travels to extreme left of combining glass.	Lead computations are incorrect.
	BIT 2	Reticle remains at RBL in azimuth after being 25 mils to left in BIT 1.	BIT malfunction - should not affect lead computing mode.
RETICLE MOTION	BIT 1 and BIT 2	Reticle remains at RBL in elevation and azimuth.	The reticle may remain fixed at the RBL in all modes.
	BIT 1 and BIT 2	Jittery Reticle.	Open loop from tachometer. This defect will be present in all modes of operation.

F4E-34-II-309-1

Figure 2-15 (Sheet 1 of 2)

OPTICAL SIGHT MALFUNCTION INDICATIONS (CONT.)

ITEM	BIT MODE	MALFUNCTION	OPTICAL SIGHT STATUS
RANGE BAR	BIT 1 and BIT 2	Range bar is in stow position.	Analog bar will remain stowed in all modes of operation and lead computing operation will not be possible.
	BIT 1	Range bar is at 1500' position.	BIT malfunction - the analog bar should function properly in all operational modes. Ranging and lead computation may be correct.
	BIT 2	Range bar is at 1000' or 4000' position.	
	BIT 1 and BIT 2	Range bar keeps driving.	Open loop - no feedback voltage from the follow-up pot. This defect will be present in all modes of operation.
	BIT 1 and BIT 2	Range bar is jittery.	No tachometer feedback to stabilize servo amplifier. This defect will be present in all modes of operation.
	BIT 1 and BIT 2	Range bar sticks.	Probably a mechanical bind is present. No mode of operation will be free of this defect.
ROLL TABS	BIT 1	Roll TABs remain at wings level.	BIT malfunction, the roll tabs may or may not work in flight.
	BIT 1 and BIT 2	Roll tabs rotate continuously.	Open loop - no feedback signal. Roll loop will not function in any mode of operation.
	BIT 1 and BIT 2	Jittery roll tabs.	No tachometer feedback. This defect will show up in all modes of operation.

F4E-34-11-309-2

Figure 2-15 (Sheet 2 of 2)

OPTICAL SIGHT CAMERA, KB-25/A

1. (AC-WSO) Gun camera switches - OFF
2. Film magazine - INSTALLED
   a. Push button (upward) in center of film magazine.
   b. Slide magazine in, and release button.
3. Frames per second switch (table) - 24 (down) or 48 (up).
4. Aperture control (table) - SET
5. Camera overrun switch - 0, 3, 10, or 20 sec.
6. Camera run button (right side) - DEPRESS
   a. Observe motor knob (left side) - ROTATE
   b. Observe magazine footage indicator.

Note

To conserve film, steps 6 and 6a may be accomplished without a magazine installed. With 100 feet of film, camera run time is 2.46 minutes at 24 fps, or 1.23 minutes at 48 fps.

BASED ON EKTACHROME MS FILM, ASA 64

MISSION	LIGHT CONDITIONS	FRAME RATE (F.P.S.)	APERTURE
Air-to-air	Daylight	24 48	f/8 f/5.6
	*Subdued	24	f/2.8
Air-to-ground	Daylight	24 48	f/11 f/8
	*Subdued	24 48	f/4 f/2.8

*Overcast, or just before dusk or dawn.

WRCS BIT CHECK (F-4E)

1. Delivery mode selector knob - OFF
2. HSI mode switches - NAV COMP
3. (WSO) Weapon delivery panel switches - SET
   a. Activate switch - NORMAL
   b. Tgt find switch - NORMAL
   c. Range switch - X100
4. (WSO) Control panel counters - SET
   a. Target distance N/S - N274
   b. Target distance E/W - E114
   c. Target alt range - 170
   d. Drag coefficient - 2.00
   e. Release advance - 900
   f. Release range - 050
   (Use 500 if step 3c is X10)

Note

A NO-GO indication will occur if the above parameters are not used during BIT.

CAUTION

When the target alt range counter is set greater than 000, do not energize the target find nor offset bomb mode unless; the aircraft altitude is greater than the altitude set in the target alt range counter, or the WRCS BIT button is depressed while performing the target find offset bomb BIT check (step 14).

5. (WSO) INS mode selector knob - ALIGN or NAV
6. (WSO) BDHI mode switch - NAV COMP
7. (WSO) Radar mode switch - MAP-PPI
8. (WSO) Radar range switch - R2
9. (WSO) Radar power - STBY

CAUTION

Radar power should remain in OFF until the aircraft is operating on internal power and the engines are up to 50% rpm minimum. This will reduce specific diode failures within the radar pulse transmitter.

10. (WSO) BIT selector knob - LAYDOWN, PUSH and HOLD
    a. Freeze button - PUSH ON (after 5 sec)
    b. Range indicator illuminates.
    c. After 15 seconds - GO/NO-GO
11. (WSO) BIT selector knob - DIVE LAYDOWN, PUSH and HOLD
    a. Freeze button - PUSH ON (after 5 sec)
    b. After 15 seconds - GO/NO-GO
12. (WSO) BIT selector knob - DIVE TOSS, PUSH and HOLD
    a. Freeze button - PUSH ON (after 5 sec)
    b. After 15 seconds - GO/NO-GO
13. (WSO) BIT selector knob - AGM-45, PUSH and HOLD
    a. BDHI and HSI miles counter - 7.6 ± 0.5 NM
    b. Alt indicator illuminates.
    c. After 5 seconds, freeze button - PUSH ON
    d. Miles counter begins to decrease.
    e. Approach indicator should indicate a pullup command (LOW).
    f. After 10 seconds, approach indicator should indicate a level command (CENTER).
    g. After 5 seconds - GO/NO-GO
    h. After 5 seconds, approach indicator should indicate a dive command (HIGH)
14. (WSO) BIT selector knob - TGT FIND OFFSET BOMB
    a. (WSO) BIT button - PUSH and HOLD
    The BIT button must be held depressed without interruption until completion of step 14m.

CAUTION

When the BIT button is depressed, the WRCS computer receives an aircraft altitude input that is higher than the target altitude inserted in step 4c. Upon completion of the BIT check, the target altitude/range counter must be set to 000. This is necessary to avoid possible damage to the WRCS pitch servo.

    b. (WSO) Along track cursor control - MOVE (after 5 sec)
    Move the along track cursor control first in a forward direction to cause the along track cursor to appear and move well up on the scope before stopping it by releasing the cursor control. Improper operation of the along track cursor control can cause the WRCS computer to function as though the RIP were behind the aircraft; i.e., the cross track cursor responds in a reverse direction to that normally obtained when the cross track cursor control is operated.
    c. (WSO) Cross track cursor - MOVE
    Outboard movement of the cross track cursor control causes the cursor to move to the right.
    d. (WSO) Reset button - PUSH
    e. (WSO) Cursors should return to center cross track and zero range.
    f. (WSO) Target insert button - PUSH ON
    g. (WSO) Along track cursor; 6.5 miles on 0° grid line (± 2000 feet). Before T.O. 1F-4E-540; cross track cursor, right 20° ± 1.5°. After T.O. 1F-4E-540; cross track cursor, right 30° ± 1.5°.
    h. (AC) HSI bearing pointer should read 23° ± 2.5° to the right of the lubber line and the TGT mode light on the HSI illuminates.
    i. (WSO) BDHI No. 1 needle should read 23° ± 2.5° to the right of the top index.
    j. (AC-WSO) HSI and BDHI miles counters should read 4.8 ± 1.0 NM.

k. ADI vertical pointer should deflect full right of center.

l. (WSO) Freeze button - PUSH ON.
Miles counter decreases to zero, then increases. The roll tabs rotate as the HSI miles counter passes through zero.

m. (WSO) After 15 seconds - GO/NO-GO

15. (WSO) WRCS control panel counters - RESET
    a. Target distance N/S - N243
    b. Target distance E/W - E/W Zero
    c. Target alt range - 243
16. (WSO) Radar power - TEST
17. (WSO) Test switch - TEST 1
18. (WSO) WRCS BIT button - PUSH and HOLD
    a. (WSO) Reset button - PUSH
    b. (WSO) Target insert button - PUSH ON
    c. (WSO) Alongtrack cursor; 5.0 miles, checked against the 5th BIT target. The near edges of each should exactly coincide. Radar receiver gain must be reduced to observe the along track cursor.
    d. (AC-WSO) Crosstrack cursor; zero azimuth (± 1.5°). Note the actual position of the azimuth cursor for in-flight evaluation of aircraft steering indicators (BDHI-HSI-ADI).
    e. HSI bearing pointer should read under aircraft lubber line (± 2.5°), sight roll tabs level, and ADI vertical pointer centered.
    f. (WSO) BDHI No. 1 needle under lubber line (± 2.5°).
19. (WSO) WRCS BIT selector knob - RELEASE and OFF
    Release the BIT button and position the BIT selector knob to OFF.
20. (WSO) Target alt/range counter - set 000

Note

- The B-sweep may not be centered on the scope because of erroneous drift inputs to the radar MAP-PPI and A/G mode when performing this BIT check on the ground.
- If aircraft power is interrupted or fluctuates during a BIT check, a NO-GO indication may result and the BIT check should be repeated.
- Disregard the NO-GO indication when a NO-GO indication is received as the WRCS BIT button is released, if a GO indication was received while the BIT button was held energized.

21. (WSO) Weapon delivery panel - CHECK
    a. Target find switch - NORM
    b. Range switch - NORM
22. (WSO) Radar power - AS REQUIRED

BOMBS (F-4E)

PREFLIGHT

Refer to part 4.

INFLIGHT

Note

After T.O. 1F-4-750 (BRU-5/A centerline rack), the following release procedures may be used to release the M118 or MK 84 GP bombs from the CL station. On unmodified aircraft, the DCU-94/A procedures may be used.

DIRECT DELIVERY MODE

Bomb Release-Armed

1. Delivery mode selector knob - DIRECT
2. Sight mode selector knob - A/G
3. Reticle depression knob - SET
4. Weapon selector knob - BOMBS
5. Arm nose tail switch - SET
6. Intrvl switch - SET (if applicable)
7. Station selector - LOADED STATION
   a. Green light(s) - ON
8. Master arm switch - ARM
   a. Amber light(s) - ON
9. Bomb button - DEPRESS
   a. Pullup light - ON
   b. When station is empty, amber light - OFF

Emergency Bomb Release

1. Weapon selector knob - BOMB/RIPPLE
2. Repeat above steps 5 thru 9, hold bomb button depressed 4 seconds.

If all bombs do not release:

3. Weapon selector knob - RKTS & DISP
4. Weapon selector knob - BOMB/RIPPLE
5. Bomb button - DEPRESS (hold 4 seconds)

DIVE TOSS/DIVE LAYDOWN

Before Bomb Run

1. Delivery mode selector knob - DIVE TOSS or DIVE LAY
2. Sight mode selector knob - A/G
   The sight reticle is electrically caged to the radar boresight line and is drift stabilized.
3. HSI mode switches - NAV COMP
   If the HSI indications are to be used, the NAV COMP position must be selected.
4. (WSO) INS mode selector knob - NAV
5. (WSO) Radar mode selector knob - AIR-GND
6. (WSO) Radar range - R1 or R2
7. (WSO) Radar power - OPR
   B-sweep, acquisition symbol, and el strobe centered on scope.
8. (WSO) Antenna stab switch - NOR

9. (P) Maneuver switch - HI-G
10. (P) WRCS drag coefficient counter - SET (Dive Toss Only)
11. (P) WRCS release range counter - SET (Dive Lay Only)
    a. Range switch - NORM or X100
12. (P) WRCS release advance - SET (if required)
13. Weapon selector knob - BOMBS
14. Arm nose tail switch - SET
15. Intrvl switch - SET (if required)

Note

The optical sight and the radar antenna is drift stabilized. Additional upwind correction must be made for the wind effect on the high drag bombs. Wind correction is not required for the low drag bombs (M117 etc.).

16. Station selector button(s) - PUSH ON
    a. Green light(s) - ON
17. Master arm switch - ARM
    a. Amber light(s) - ON

Bomb Run

1. (P) Receiver gain - MINIMUM
2. (P) Lockon target (CALL)
3. Bomb release button - DEPRESS AND HOLD
    a. After bomb release, pullup light - ON
    b. After station is empty, amber light - OFF
       During the initial dive toward the target area, the pilot reduces the receiver gain to obtain a single return, depress the action switch to Half Action, place the range strobe in the center of the return, and then depress the action switch to Full Action and release. After lockon, the AC places the pipper on target, depresses and holds the bomb release button, and initiates the desired delivery maneuver. After the bomb is automatically released, the pullup light will illuminate and will go out when the bomb button is released. The amber light will go out when the station is empty.

LAYDOWN

Before Bomb Run

1. Delivery mode selector knob - LAYDOWN
2. Sight mode selector knob - A/G
3. Reticle depression counter - SET (if required)
   Set the IP-to-target sight setting.
4. HSI mode switches - NAV COMP
   If the HSI steering information is to be used, the NAV COMP position must be selected.
5. (P) INS mode selector knob - NAV
6. (P) WRCS target range counter - SET
   Set the distance from IP to target.
7. (P) WRCS release range counter - SET
    a. Range switch - NORM or X100
8. (P) WRCS release advance counter - SET (if required)
9. Weapon selector knob - BOMBS
10. Arm nose tail switch - SET
11. Intrvl switch - SET (if required)
12. Station selector button(s) - PUSH ON
    a. Green light - ON
13. Master arm switch - ARM
    a. Amber light - ON

Bomb Run

Approach the target at the preplanned release altitude and airspeed. When the aircraft is directly over the IP, or when the pipper is on target, depress and hold the bomb release button. Maintain a constant airspeed, altitude, and course until the bomb is automatically released. The pullup light will illuminate to indicate bomb release and will go out when the bomb button is released. Wind corrections for the bomb must be applied prior to depressing the bomb button.

1. Bomb release button - DEPRESS AND HOLD
    a. At bomb release, pullup light - ON
    b. When a station is empty, amber light - OFF

OFFSET BOMBING/TARGET FIND

Before IP

1. Delivery mode selector knob - OFFSET BOMB or TGT FIND
2. Sight mode selector knob - A/G
   The optical sight reticle is electrically caged to the RBL and to 0° in azimuth. The roll tabs display aircraft attitude until target insert, then steering commands to the target.
3. Navigation mode selector knob - NAV COMP
4. HSI mode switches - NAV COMP
   If the HSI indications are to be used, the NAV COMP position must be selected.
5. (P) INS mode selector knob - NAV
6. (P) BDHI mode switch - NAV COMP
7. (P) Weapon delivery panel - SET
    a. Activate switch - NORMAL
    b. Tgt Find switch - NORMAL
    c. Range switch - AS REQUIRED

Note

The position of the range switch will affect the value placed in the release RANGE readout: times 10 (NORMAL), or times 100.

8. (P) WRCS input counters - SET
    a. Target distance N/S -100-ft increments.
    b. Target distance E/W -100-ft increments.
    c. IP altitude MSL - 100-ft increments.
    d. Release range - 10-ft or 100-ft increments (Offset bomb)
    e. Release advance - Milliseconds (Offset bomb, if required)
9. Weapon selector knob - BOMBS (Offset bomb)

Note

The ADI will not provide steering if the weapon selector knob is on AGM-45.

10. Arm nose tail switch - SET
11. Intrvl switch - SET (if required)

12. Station selector button(s) - PUSH ON
    a. Green light - ON
13. Master arm switch - ARM
    a. Amber light - ON

Bomb Run-Offset Radar IP

1. (P) Radar power - OPR
2. (P) Radar mode switch - MAP-PPI
3. (P) Antenna stab switch - NOR
4. (P) Cursor intensity - ADJUST
5. (P) Antenna elevation - ADJUST
6. (P) Scan switch - WIDE
7. (P) Radar range selector knob - R2 or R3
8. (P) Operate the along track cursor to position the range cursor over the RIP.
9. (P) Operate the cross track cursor to position the offset cursor over the RIP.
10. (P) Freeze button - PUSH ON

Note

- The along track cursor must be moved first to initiate cursor control. Position the intersection of the cursors over the RIP and then push the freeze button ON; the cursors begin tracking the RIP. The cursors can be moved to touch-up the intersection location over the RIP after the Freeze button is pushed on.
- Do not position the range cursor below zero range. If the range cursor is moved below zero range and then moved out over the IP, the steering information will be in error by 180° even though the cursor responds normally to along track cursor control movements.

11. (P) Target insert button - PUSH ON
    The steering instruments display steering commands when the target insert button is pushed ON, and the cursor intersection will position over the target location and track the target. If the target is on the scope, set the target elevation on the ALT RANGE counter and touch-up the cursors over the target.
12. Bomb release button - DEPRESS AND HOLD (Offset bomb)
    a. At bomb release, pullup light - ON
    b. When a station is empty, amber light - OFF
       When the aircraft is on course to the target and at the preplanned release altitude and airspeed, depress and hold the bomb release button until the bomb is released, as indicated by illumination of the pullup light.

Note

The roll tabs rotate as the target is passed, and the BDHI and HSI distance-to-target counters will approach zero and then start increasing in value.

Bomb Run-Visual IP Fly-Over

1. (P) When over IP, freeze button and target insert button - PUSH ON
   When the aircraft is directly over the IP, the freeze button and the target insert button are pushed ON simultaneously. The steering instruments supply steering commands to the target, and the cursors will position over, and start tracking the target. If the target is visible on the scope, the pilot may touch-up the cursors when the target elevation is set in the ALT RANGE control.
2. Bomb release button - DEPRESS AND HOLD (Offset bomb)
   a. At bomb release, pullup light - ON
   b. When a station is empty, amber light - OFF
      When the aircraft is on course to the target and at the preplanned release altitude and true airspeed, depress and hold the bomb release button until bomb release occurs, indicated by the illumination of the pullup light.

Note

The roll tabs rotate as the target is passed, and the BDHI and HSI distance-to-target counters will approach zero and then start increasing in value.

LABS/OFFSET BOMB/TGT FIND

After Takeoff

1. Delivery mode selector knob - OFFSET BOMB or TGT FIND
2. (P) Target find switch - HOLD
   Select HOLD on the weapon delivery panel.
3. Sight mode selector knob - A/G
   The optical sight reticle is electrically caged to the RBL and to 0° in azimuth. The roll tabs display aircraft attitude until target insert, then steering commands to the target.
4. Navigation mode selector knob - NAV COMP
5. HSI mode switches - NAV COMP
   If the HSI indications are to be used, the NAV COMP position must be selected.
6. (P) INS mode selector knob - NAV
7. (P) BDHI mode switch - NAV COMP
8. (P) WRCS input counters - SET
   a. Target distance N/S - 100-ft increments
   b. Target distance E/W - 100-ft increments
   c. IP altitude MSL - 100-ft increments
   d. Release range - 10-ft or 100-ft increments (Offset bomb)
   e. Release range - LABS pullup range, 10-ft or 100-ft increments

Note

The (X100) factor is selected through the range switch on the weapon delivery panel.

   f. Release advance - Milliseconds (Offset bomb, if required)
9. Weapon selector knob - BOMBS (Offset bomb)

Note

The ADI will not provide steering if the weapon selector knob is on AGM-45.

10. Arm nose tail switch - SET
11. Intrvl switch - SET (if required)
12. Station selector button(s) - PUSH ON
    a. Green light - ON
13. Master arm switch - ARM
    a. Amber light - ON
14. (P) Dual timers - SET
    a. Pullup timer - T_1
    b. Release timer - T_2
15. (P) Release gyro - SET
    a. Low angle (LOFT) - DEG

Before Bomb Run

1. (P) Radar power - OPR
2. (P) Radar mode switch - MAP PPI
3. (P) Antenna stab switch - NOR
4. (P) Cursor intensity - ADJUST
5. (P) Antenna elevation - ADJUST
6. (P) Scan switch - WIDE
7. (P) Radar range selector knob - R2 or R3

Bomb Run-Offset Radar IP

1. (P) Operate the along track control to position the range cursor over the RIP.
2. (P) Operate the cross track control to position the offset cursor over the RIP.
3. (P) Freeze button - PUSH ON

Note

- The along track cursor must be moved first to initiate cursor control. Position the intersection of the cursors over the RIP and then push the freeze button ON; the cursors begin tracking the RIP. The cursors can be moved to touch-up the intersection location over the RIP after the Freeze button is pushed on.

- Do not position the range cursor below zero range. If the range cursor is moved below zero range and then moved out over the IP, the steering information will be in error by 180° even though the cursor responds normally to along track cursor control movements.

4. (P) Target insert button - PUSH ON
   The steering instruments display steering commands when the target insert button is pushed ON, and the cursor intersection will position over the target location and track the target. If the target is on the scope, set the target elevation on the ALT RANGE counter and touch-up the cursors over the target.
5. Bomb release button - DEPRESS AND HOLD (Offset bomb)
   a. At bomb release, pullup light - ON
   b. When a station is empty, amber light - OFF
      When the aircraft is on course to the target and at the preplanned release altitude and airspeed, depress and hold the bomb release button until the bomb is released, as indicated by illumination of the pullup light.

Note

The roll tabs rotate as the target is passed, and the BDHI and HSI distance-to-target counters will approach zero and then start increasing in value.

Bomb RunVisual IP Fly-Over

1. (P) When over IP, freeze button and target insert button - PUSH ON
   When the aircraft is directly over the IP, the freeze button and the target insert button are pushed ON simultaneously. The steering instruments supply steering commands to the target, and the cursors will position over, and start tracking the target. If the target is visible on the scope, the pilot may touch-up the cursors when the target elevation is set in the ALT RANGE control.
2. Bomb release button - DEPRESS AND HOLD (Offset bomb)
   a. At bomb release, pullup light - ON
   b. When a station is empty, amber light - OFF
      When the aircraft is on course to the target and at the preplanned release altitude and true airspeed, depress and hold the bomb release button until bomb release occurs, indicated by the illumination of the pullup light.

Note

The roll tabs rotate as the target is passed, and the BDHI and HSI distance-to-target counters will approach zero and then start increasing in value.

Bomb Run Labs/TGT Find

1. Delivery mode selector (LABS) - AS REQUIRED
   Select the planned delivery mode.

Note

With the TGT find switch on HOLD, the delivery mode selector may be positioned to any LABS mode without losing WRCS function.

2. (P) Along track and cross track controls - AS REQUIRED (Visual or Radar IP)
3. (P) Freeze control - PUSH ON
4. (P) Target Insert control - PUSH ON
5. (P) After target insert, activate switch - ON
   Select the ON position only after steering instruments have transitioned to target.
6. At warning tone (T_1 start) - MIL POWER PULLUP
7. Bomb button - DEPRESS AND HOLD

LOFT BOMBING-RIPPLE RELEASE

Before Bomb Run

1. (P) Activate switch - NORMAL
   When the WRCS is not used with the LABS modes, the target find switch and/or the activate switch on the weapons delivery panel must be positioned to NORMAL.

2. (P) Low angle knob - SET
3. (P) Pull up timer - SET
4. (P) Release timer - SET ZERO
5. Delivery mode selector knob - LOFT
6. Pedestal panel - SET
   a. Weapon selector knob - BOMB/RIPPLE
   b. Arm nose tail switch - NOSE & TAIL
   c. Intrvl switch - SET
   d. Station selector button(s) - PUSH ON
      (1) Green light - ON
   e. Master arm switch - ARM
      (1) Amber light - ON

At IP

1. Bomb button - DEPRESS AND HOLD
   The bomb button must be energized until the final bomb is released.
2. At pullup point, throttles - FULL MIL POWER

Loft Bomb Delivery

Approach the IP at the preplanned altitude and true airspeed. When over the IP, depress and hold the bomb button energized until the final bomb is released. When the bomb button is depressed, the pullup light will illuminate, the pullup timer will begin, and the ADI pointers will center. Upon completion of the pullup timer, the pullup light and the reticle light will go out and the horizontal pointer will begin programming a 4-G pullup. This is the signal to the AC to select full military power and begin rotation into the pullup maneuver by flying the ADI pointers (4-G pullup) or the accelerometer. Since the sight reticle is pitch stabilized, it will not be in view above loft angles of 20°. When the aircraft attitude is at the preselected release angle, the pullup light and the reticle light illuminate and the bombs will begin releasing in a ripple sequence. After the final bomb is released, the bomb button is released and the AC initiates a wingover escape maneuver to achieve a 120° turn while diving toward minimum escape altitude. When the bomb button is released, the pullup light will go out, and the horizontal pointer will move out of view.

After Escape Maneuver

1. Master arm switch - SAFE
2. Station selector buttons (5) - OFF
3. Delivery mode selector knob - OFF
   Placing the delivery mode selector knob to OFF removes power from the bombing timers.

CENTERLINE WEAPON RELEASE (DCU-94/A)

Before Bomb Run

1. Delivery mode selector knob - DIRECT or AS REQUIRED
2. Optical sight - SET (if required)
3. (P) Nuclear store consent switch - REL/ARM
4. DCU-94/A CL station selector switch - FORWARD
5. Arm nose tail switch - ARM

Bomb Run

1. DCU-94/A master release lock switch - FORWARD
   a. CL UNLOCKED light - ON
2. Master arm switch - ARM
   The master arm switch allows power to the arm nose tail switch.
3. Delivery maneuver - EXECUTE
   If the DIRECT delivery mode is selected, the bomb is released when the bomb button is depressed.

Note

If the bomb does not release, recheck switch positions, select the DIRECT release mode and depress bomb button, or energize the nuclear store jettison control.

POST STRIKE

Before Landing

1. Master arm switch - SAFE
2. Station select - OFF
3. Gun & stores switch - NORMAL
4. Sight mode selector knob - STBY or CAGE
5. All DCU-94/A station selector switches (5) - AFT
6. Missile arm switch - SAFE
7. Missile power switch - OFF
8. Missile jett knob - OFF

Armament Area (De-Arming)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

ROCKETS (F-4E)

PREFLIGHT

Refer to part 4, figure 2-22.

INFLIGHT

ROCKET FIRING

1. Delivery mode selector knob - DIRECT
2. Sight mode selector knob - A/G
3. Reticle depression knob - SET
4. Weapon selector knob - RKTS & DISP/SINGLE
5. Station select - LOADED STATIONS
   a. Green light - ON
6. Master arm switch - ARM
   a. Amber light - ON
7. Bomb button - DEPRESS

LAUNCHER RELEASE

1. Delivery mode selector knob - DIRECT
2. Weapon selector knob - BOMBS/RIPPLE
3. Repeat above steps 5, 6, and 7, hold bomb button depressed 4 seconds.
   a. When station is empty, amber light - OFF

If all launchers do not release:

4. Weapon selector knob - RKTS & DISP
5. Weapon selector knob - BOMBS/RIPPLE
6. Bomb button - DEPRESS (Hold 4 seconds)

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select - OFF
3. Gun & stores switch - NORMAL
4. Sight mode selector knob - STBY or CAGE
5. All DCU-94/A station selector switches (5) - AFT
6. Missile arm switch - SAFE
7. Missile power switch - OFF
8. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

CBU AND FLARE DISPENSERS (F-4E)

PREFLIGHT

Refer to part 4, figure 2-23.

INFLIGHT

DIRECT DELIVERY MODE

Dispensing

1. Delivery mode selector knob - DIRECT
2. Sight mode selector knob - A/G
3. Reticle depression knob - SET
4. Weapon selector knob - RKTS & DISP
   a. (SUU-13, -38, -42) Weapon selector knob - RKTS & DISP/SINGLE
5. (SUU-7) Intrvl switch - SET (if required)
6. Station select - LOADED STATIONS
   a. Green light - ON
7. Master arm switch - ARM
   a. Amber light - ON
8. Bomb button - DEPRESS AND HOLD AS REQUIRED
9. SUU-7 CBU lights - MONITOR
   a. Blinking light - Tubes Remaining
   b. Amber light out - All tubes have received a firing pulse.

Note

The CBU lights will not monitor the empty status of the flare dispenser, SUU-13, SUU-38, SUU-42.

Dispenser Release

1. Delivery mode selector knob - DIRECT
2. Weapon selector knob - BOMBS/RIPPLE
3. Repeat above steps 6 thru 9, hold bomb button depressed 4 seconds

If all dispensers do not release:

4. Weapon selector knob - RKTS & DISP
5. Weapon selector knob - BOMBS/RIPPLE
6. Bomb button - DEPRESS (Hold 4 seconds)

DIVE LAYDOWN

Before Bomb Run

1. Delivery mode selector knob - DIVE LAY
2. Sight mode selector knob - A/G
   The sight reticle is electrically caged to the radar boresight line and is drift stabilized.
3. HSI mode switches - NAV COMP
   If the HSI indications are to be used, the NAV COMP position must be selected.
4. (P) INS mode selector knob - NAV
5. (P) Radar mode selector knob - AIR-GND
6. (P) Radar range - R1 or R2
7. (P) Radar power - OPR
   B-sweep, acquisition symbol, and el strobe centered on scope.
8. (P) Antenna stab switch - NOR

9. (P) Maneuver switch - HI-G
10. (P) WRCS release range counter - SET
    a. Range switch - NORM or X100
11. (P) WRCS release advance - SET (if required)
12. Weapon selector knob - RKTS & DISP
    a. (SUU-13, -38, -42) Weapon selector knob - RKTS & DISP/SINGLE
13. (SUU-7) Intrvl switch - SET (if required)

Note

The optical sight and the radar antenna is drift stabilized. Upwind correction must be made for the wind effect on the high drag bombs. Wind correction is not required for the low drag bombs (M117, MK 82 LDGP, etc.).

14. Station selector button(s) - PUSH ON
    a. Green light(s) - ON
15. Master arm switch - ARM
    a. Amber light(s) - ON

Bomb Run

1. (P) Receiver gain - MINIMUM
2. (P) Lockon target.
3. Bomb release button - DEPRESS AND HOLD
4. (SUU-7) Amber CBU lights - MONITOR
    a. Blinking light - Tubes remaining
    b. Amber light out - All tubes have received a firing pulse.

Note

The CBU lights will not monitor the empty status of the flare dispenser, SUU-13, SUU-38, SUU-42.

During the initial dive toward the target area, the pilot reduces the receiver gain to obtain a single return, depress the action switch to Half-Action, place the range strobe in the center of the return, and then depress the action switch to Full-Action and release. After lockon, the AC places the pipper on target, depresses and holds the bomb release button, and initiates the desired delivery maneuver. After the bomb is automatically released, the pullup light will illuminate and will go out when the bomb button is released.

LAYDOWN

Before Bomb Run

1. Delivery mode selector knob - LAYDOWN
2. Sight mode selector knob - A/G
3. Reticle depression counter - SET (if required)
   Set the IP-to-target sight setting.
4. HSI mode switches - NAV COMP
   If the HSI steering information is to be used, the NAV COMP position must be selected.
5. (P) INS mode selector knob - NAV
6. (P) WRCS target range counter - SET
   Set the distance from IP to target.
7. (P) WRCS release range counter - SET
    a. Range switch NORM or X100
8. (P) WRCS release advance counter - SET (if required)
9. Weapon selector knob - RKTS & DISP
    a. (SUU-13, -38, -42) Weapon selector knob - RKTS & DISP/SINGLE
10. (SUU-7) Intrvl switch - SET (if required)
11. Station selector button(s) - PUSH ON
    a. Green light - ON
12. Master arm switch - ARM
    a. Amber light - ON

Bomb Run

Approach the target at the preplanned release altitude and airspeed. When the aircraft is directly over the IP, or when the pipper is on target, depress and hold the bomb release button. Maintain a constant airspeed, altitude, and course until the bomb is automatically released. The pullup light will illuminate to indicate bomb release and will go out when the bomb button is released. Wind corrections for the bomb must be applied prior to depressing the bomb button.

1. Bomb release button - DEPRESS AND HOLD
2. SUU-7 CBU lights - MONITOR
    a. Blinking light - Tubes Remaining
    b. Amber light out - All tubes have received a firing pulse.

Note

The CBU lights will not monitor the empty status of the flare dispenser, SUU-13, SUU-38, SUU-42.

OFFSET BOMBING/TARGET FIND

Before IP

1. Delivery mode selector knob - OFFSET BOMB or TGT FIND
2. Sight mode selector knob - A/G
   The optical sight reticle is electrically caged to the RBL and to 0° in azimuth. The roll tabs display aircraft attitude until target insert, then steering commands to the target.
3. Navigation mode selector knob - NAV COMP
4. HSI mode switches - NAV COMP
   If the HSI indications are to be used, the NAV COMP position must be selected.
5. (P) INS mode selector knob - NAV
6. (P) BDHI mode switch - NAV COMP
7. (P) Weapon delivery panel - SET
    a. Activate switch - NORMAL
    b. Tgt find switch - NORMAL
    c. Range switch - AS REQUIRED
8. (P) WRCS input counters - SET
    a. Target distance N/S - 100-ft increments
    b. Target distance E/W - 100-ft increments
    c. IP altitude MSL - 100-ft increments
    d. Release range - 10-ft or 100-ft increments (Offset bomb)
    e. Release advance - Milliseconds (Offset bomb, if required)

9. Weapon selector knob - RKTS & DISP (Offset bomb)
   a. (SUU-13, -38, -42) Weapon selector knob - RKTS & DISP/SINGLE
10. (SUU-7) Intrvl switch - SET (if required)

Note

The ADI will not provide steering if the weapon selector knob is on AGM-45.

11. Station selector button(s) - PUSH ON
    a. Green light - ON
12. Master arm switch - ARM
    a. Amber light - ON

Bomb Run-Offset Radar IP

1. (P) Radar power - OPR
2. (P) Radar mode switch - MAP-PPI
3. (P) Antenna stab switch - NOR
4. (P) Cursor intensity - ADJUST
5. (P) Antenna elevation - ADJUST
6. (P) Scan switch - WIDE
7. (P) Radar range selector knob - R2 or R3
8. (P) Operate the along track cursor to position the range cursor over the RIP.
9. (P) Operate the cross track cursor to position the offset cursor over the RIP.
10. (P) Freeze button - PUSH ON

Note

- The along track cursor must be moved first to initiate cursor control. Position the intersection of the cursors over the RIP and then push the freeze button ON; the cursors begin tracking the RIP. The cursors can be moved to touch-up the intersection location over the RIP after the Freeze button is pushed on.
- Do not position the range cursor below zero range. If the range cursor is moved below zero range and then moved out over the IP, the steering information will be in error by 180° even through the cursor responds normally to along track cursor control movements.

11. (P) Target insert button - PUSH ON
    The steering instruments display steering commands when the target insert button is pushed ON, and the cursor intersection will position over the target location and track the target. If the target is on the scope, set the target elevation on the ALT RANGE counter and touch-up the cursors over the target.
12. Bomb release button - DEPRESS AND HOLD (Offset bomb)
13. SUU-7 CBU lights - MONITOR
    a. Blinking light - Tubes Remaining
    b. Amber light out - All tubes have received a firing pulse.
       When the aircraft is on course to the target and at a preplanned release altitude and airspeed, depress and hold the bomb release button until the bomb is released, as indicated by illumination of the pullup light.

Note

The roll tabs rotate as the target is passed, and the BDHI and HSI distance-to-target counters will approach zero and then start increasing in value.

Note

The CBU lights will not monitor the empty status of the flare dispenser, SUU-13, SUU-38, SUU-42.

Bomb Run - Visual IP Fly-Over

1. (P) When over IP, freeze button and target insert button - PUSH ON
   When the aircraft is directly over the IP, the freeze button and the target insert button are pushed ON simultaneously. The steering instruments supply steering commands to the target, and the cursors will position over, and start tracking the target. If the target is visible on the scope, the pilot may touch-up the cursors when the target elevation is set in the ALT RANGE control.
2. Bomb release button - DEPRESS AND HOLD (Offset bomb)
3. SUU-7 CBU lights - MONITOR
   a. Blinking light - Tubes Remaining
   b. Amber light out - All tubes have received a firing pulse.
      When the aircraft is on course to the target and at a preplanned release altitude and true airspeed, depress and hold the bomb release button until bomb release occurs, indicated by the illumination of the pullup light.

Note

The roll tabs rotate as the target is passed, and the BDHI and HSI distance-to-target counters will approach zero and then start increasing in value.

POST STRIKE

Before Landing

1. Master arm switch - SAFE
2. Station select - OFF
3. Guns & stores switch - NORMAL
4. Sight mode selector knob - STBY, or CAGE
5. All DCU-94/A station selector switches (5) - AFT
6. Missile arm switch - SAFE
7. Missile power switch - OFF
8. Missile jett knob - OFF

Armament Area (De-Arming)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

A/B 45-1, Y-2, Y-4 SPRAY TANK DISPENSERS (F-4E)

PREFLIGHT

Refer to part 4, figure 2-24.

INFLIGHT

DISPENSING

1. Delivery mode selector knob - DIRECT
2. Station select - LOADED STATIONS
   a. Green light - ON
3. Weapon selector knob - RKTS & DISP, SINGLE
4. Arm nose tail switch - NOSE & TAIL
5. Master arm switch - ARM
   a. Amber light - ON

Note

Placing the master arm switch to ARM arms the A/B 45Y-1 tank causing an explosive squib to discharge, thereby pressurizing the bladder of liquid.

WARNING

Once the A/B 45Y-1 is armed, it cannot be de-armed and therefore must not be brought back to base.

Note

- On the A/B 45Y-2 dry agent spray tank, energizing the master arm switch causes the agent container to be pressurized by ram air for proper dissemination. The Y-2 tank can be de-armed by positioning the master arm switch to SAFE.
- On the A/B 45Y-4 dry agent spray tank, energizing the master arm switch arms the tank. The Y-4 tank can be de-armed by positioning the master arm switch to SAFE.

6. Bomb button - DEPRESSED
7. Amber light - MONITOR
   a. Blinking amber light - spray remaining
   b. Amber light out - no spray remaining

DISPENSER RELEASE

1. Wing tank jettison switch - JETT

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select - OFF
3. Guns & store switch - NORMAL
4. Sight mode selector knob - STBY, or CAGE
5. All DCU-94/A station selector switches (5) - AFT
6. Missile arm switch - SAFE
7. Missile power switch - OFF
8. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

TMU-28/B SPRAY TANK (F-4E)

PREFLIGHT

Refer to part 4, figure 2-24.

INFLIGHT

1. Weapon selector knob - A/G MISSILE (Not in RKTS & DISP)
2. Arm nose tail switch - SAFE
3. Master arm switch - SAFE

DISPENSING

1. Station selector button(s) - SELECT LOADED STATION(S)
   a. Green light(s) - ON
2. Master arm switch - ARM
   a. Amber light(s) remain - OFF
3. To extend boom, weapon selector knob - RKTS & DISP/SINGLE
   a. While boom is extending, amber light(s) - ON STEADY
   b. Boom fully extended, amber light(s) - BLINKING
4. To begin dispensing, bomb button - DEPRESS AND HOLD (8 sec)
5. To stop dispensing, bomb button - RELEASE
6. Weapon selector knob - A/G MISSILE (Not in RKTS & DISP)
7. To retract boom, arm nose tail switch - NOSE & TAIL
   a. Amber light continues to blink after boom is retracted.

Note

The amber light will continue to blink until power is removed from the aircraft, except when the station selector button is pushed off. When the station selector button is pushed on, the light will begin blinking again.

8. Station selector button(s) - PUSH OFF
   a. Green and amber lights - OFF

DISPENSER RELEASE

1. Wing tank jettison switch - JETT

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select - OFF
3. Guns & store switch - NORMAL
4. Sight mode selector knob - STBY, or CAGE.
5. All DCU-94/A station selector switches (5) - AFT
6. Missile arm switch - SAFE
7. Missile power switch - OFF
8. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

PAU-7/A SPRAY TANK (F-4E)

PREFLIGHT

Refer to part 4, figure 2-24.

INFLIGHT

1. Weapon selector knob - A/G MISSILE (NOT RKTS & DISP)
2. Arm nose tail switch - SAFE
3. Master arm switch - SAFE

DISPENSING

1. Station selector buttons - RO, LO, OR BOTH AS REQUIRED
   a. Green select light(s) - ON
2. Weapon selector knob - RKTS & DISP/SINGLE
3. Bomb mode selector knob - DIRECT
4. Master arm switch - ARM
5. To extend boom, arm nose tail switch - NOSE & TAIL
6. To dispense, bomb button - DEPRESS & HOLD Tank will dispense with boom up or down.
7. To stop dispensing, bomb button - RELEASE
8. To retract boom, arm nose tail switch - TAIL (90 sec)
9. Station selector button(s) - PUSH OFF (after boom retract)
   a. Green light(s) - OFF
10. Delivery mode select knob - OFF

DISPENSER RELEASE

1. Wing tank jettison switch - JETT

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select button(s) - OFF
3. Guns & store switch - NORMAL
4. Sight mode selector knob - STBY or CAGE
5. All DCU-94/A station selector switches (5) - AFT
6. Missile arm switch - SAFE
7. Missile power switch - OFF
8. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

SUU-16/A, -23/A GUN POD (F-4E)

PREFLIGHT

Refer to part 4, figure 2-25.

INFLIGHT

STRAFING

1. Sight mode selector knob - A/G
2. Reticle depression counter - SET

Note

- If the optical is to be used, the OFF or DIRECT position should be selected on the delivery mode selector panel.
- Reference to the RAT (ram air turbine) is applicable to the SUU-16/A gun pod only.

3. Gun clear switch - NONCLEAR or AUTO CLEAR

4. Weapon selector knob - GUNS or AS REQUIRED
   When BOMBS or RKTS & DISP are selected, the guns and stores switch must be in guns and stores to select the guns.
5. Guns and stores switch - NORMAL or GUNS & STORES
   When the weapon selector knob is positioned to GUNS, the switch should be in NORMAL.
6. Station selector button(s) - PUSH LOADED STATION(S)
   a. Green light(s) - ON (SUU-23 Prestart)
7. Master arm switch - ARM
   a. Amber light(s) - ON, RAT OUT (SUU-16)
      The RAT will extend when the master arm switch is placed to ARM.
8. Trigger switch - ACTUATE

AIR-TO-AIR

1. Sight mode selector knob - A/A
2. Gun clear switch - NONCLEAR or AUTO CLEAR
3. Weapon selector knob - GUNS or AS REQUIRED
4. Guns and stores switch - NORMAL or GUNS & STORES
5. Station selector button(s) - PUSH LOADED STATION(S)
   a. Green light(s) - ON (SUU-23 Prestart)
6. (WSO) Radar power - OUT OF OFF
7. (WSO) Radar mode switch - AS REQUIRED
8. (WSO) Radar range - R1
9. Master arm switch - ARM
   a. Amber light(s) - ON, RAT OUT (SUU-16)
      The RAT will extend when the master arm switch is placed to ARM.
10. (WSO) Target lock-on - ACCOMPLISH
11. Trigger switch - ACTUATE

FINAL BURST SAFE GUNS (Rounds Remaining)

1. Gun clear switch - AUTO CLEAR
2. Trigger switch - ACTUATE
3. Station selector button - PUSH OFF
   a. Green light - OFF
   b. Amber light - OFF, RAT IN (SUU-16)
      The RAT will retract when the station selector button is pushed OFF.
4. Guns and stores switch - NORMAL
5. Master arm switch - SAFE

BEFORE LANDING

1. Master arm switch - SAFE
2. Station selector knob - OFF
3. Guns & stores switch - NORMAL
4. Sight mode selector knob - STBY or CAGE
5. All DCU-94/A station selector switches (5) - AFT
6. Missile arm switch - SAFE
7. Missile power switch - OFF
8. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

M61A1 NOSE GUN (F-4E)

PREFLIGHT

Refer to part 4.

EXTERIOR INSPECTION

(Not Applicable)

INFLIGHT

STRAFING

1. Sight mode selector knob - A/G
2. Reticle depression counter - SET

Note

With the sight in the A/G mode, the OFF or DIRECT position should be selected on the delivery mode selector panel.

3. Rounds counter - SET
4. Rate switch - HIGH or LOW
5. Weapon selector knob - GUNS or AS REQUIRED
   When BOMBS or RKTS & DISP are selected, the guns and stores switch must be in GUNS & STORES to select the guns.
6. Guns and stores switch - NORMAL or GUNS & STORES
7. Nose station selector button - PUSH ON
   a. Green light - ON
8. Master arm switch - ARM
   a. Amber light - ON
9. Trigger switch - ACTUATE
   a. Zero rounds remaining - AMBER LIGHT OFF

AIR-TO-AIR

1. Sight mode selector knob - A/A
2. Rounds counter - SET
3. Rate switch - HIGH or LOW
4. Weapon selector knob - GUNS
5. Station selector button(s) - PUSH ON
   a. Green light - ON
6. (WSO) Radar power - OPR
7. (WSO) Radar mode switch - AS REQUIRED
8. (WSO) Radar range - AS REQUIRED
9. Master arm switch - ARM
   a. Amber light - ON
10. (WSO) Target lock-on - ACCOMPLISH
11. Trigger switch - ACTUATE
    a. Zero rounds remaining - AMBER LIGHT OFF

SAFE GUNS

1. Nose station selector button - PUSH OFF
   a. Green light - OFF
   b. Amber light - OFF
2. Master arm switch - SAFE

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select - OFF
3. Guns & stores sw - NORMAL
4. Sight mode selector knob - STBY or CAGE
5. All DCU-94/A station selector switches (5) - AFT
6. Missile arm switch - SAFE
7. Missile power switch - OFF
8. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

AGM-12B/C/E MISSILE (F-4E)

PREFLIGHT

Refer to part 4, Cockpit Weapons Check and Exterior Inspection (AGM-12B/C/E Missiles)

INFLIGHT

TRANSMITTER CHECK

Perform an airborne check as follows:

1. Delivery mode select knob - DIRECT
2. Station selector buttons - OFF
   a. Green lights - OFF
3. Warning lights test sw - TEST
   a. Station green and amber lights - ON
4. Weapon selector knob - AGM-12
5. Master arm switch - ARM
   a. All station amber lights - OFF
6. Bomb button - DEPRESS
7. Control handle - TRANSMIT COMMANDS
   The transmitter timer is energized for 50 ± 10 seconds.
8. Master arm switch - SAFE

BEFORE MISSILE LAUNCH

1. (ACP) Oxygen diluter selector - 100 PERCENT
2. Weapon selector knob - AGM-12
3. Station selector button - DEPRESS
   a. Green light - ON

MISSILE LAUNCH

1. Master arm switch - ARM
   a. Station amber light - ON
2. Bomb button - DEPRESS (2 sec approx)
   Depress and hold the bomb button until the missile fires or until the launch is aborted due to missile malfunction.

To immediately arm a second missile for re-attack:

3. Station selector button (just fired) - DEPRESS
   a. Green light - OFF
4. Station selector button (next missile) - DEPRESS
   a. Green light - ON
   b. Amber light - ON

MISSILE FLIGHT (AGM-12E)

To prevent AGM-12E warhead from functioning

1. (WSO) Armament power circuit breaker - PULL (6B, No. 1 panel)
   If it is necessary to safe the missile, pull circuit breaker 6B.

AFTER MISSILE ATTACK

1. Armament switches - OFF/SAFE
   a. Master arm switch - SAFE
   b. Station selector buttons - OFF
2. Emergency vent handle - CYCLE
   Pull to de-pressurize, then push to pressurize to cycle cockpit air in case of contamination by missile exhaust gases.

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select - OFF
3. Guns & stores switch - NORMAL
4. Sight mode selector knob - STBY, or CAGE
5. All DCU-94/A station select switches (5) - AFT
6. Missile arm switch - SAFE
7. Missile power switch - OFF
8. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

SUU-20 BOMB/ROCKET DISPENSERS (F-4E)

PREFLIGHT

Refer to part 4.

INFLIGHT

ROCKET DELIVERY

1. Sight mode selector knob - A/G
2. Reticle depression knob - SET
3. Delivery mode selector knob - DIRECT
4. Intrvl switch - .10 OR .14 ONLY
5. Station select - AS REQUIRED
   a. Green light - ON
6. Weapon selector knob - RKTS & DISP
7. Master arm switch - ARM
   a. Amber light - ON

BOMB DELIVERY

1. Sight mode selector knob - A/G
2. Reticle depression knob - SET
3. Delivery mode selector knob - AS REQUIRED
4. Intrvl switch - .10 OR .14
5. Station select - AS REQUIRED
   a. Green light - ON
6. Weapon selector knob - BOMBS/SINGLE/RIPPLE/TRIPLE
7. Master arm switch - ARM
   a. Amber light - ON

Note

- There is no cockpit indication to determine that all bombs or rockets have been released or fired.
- The intervalometers within the SUU-20 cannot be rehomed in flight for an attempt to release or fire a hung bomb or rocket.
- Do not use an aircraft interval setting of 0.06.

BEFORE LANDING

1. Master arm switch - SAFE
2. Station selector knob - OFF
3. Guns & stores switch - NORMAL
4. Sight mode selector knob - STBY or CAGE
5. All DCU-94/A station selector switches (5) - AFT
6. Missile arm switch - SAFE
7. Missile power switch - OFF
8. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

SUU-21/A BOMB DISPENSER (F-4E)

PREFLIGHT

Refer to part 4, cockpit weapons check and Exterior Inspection (SUU-21/A)

INTERIOR INSPECTION (DCU-94/A)

Before applying external power:

1. All station selector switches (5) - AFT
2. Station select switch guard - INSTALLED
   If other munitions are aboard, the required guard should be installed.
3. Master release lock switch - AFT
4. Option selector knob - OFF
5. Bomb mode select knob - OFF
6. (P) Nuclear store consent switch - SAFE

With the dispenser doors open, proceed as follows:

7. External power - APPLY
8. Generator switches - EXT ON
9. Lamp test button - PRESS
   a. Warn and unlocked lights - ON
10. Option selector knob - SAFE
    a. Loaded station warn light(s) - FLASHING (doors closing)
    b. Loaded station warn light(s) - OFF (doors closed)
11. Option selector knob - OFF

INFLIGHT

ON BOMB RANGE (DCU-94/A)

1. Option selector knob - SAFE
2. Loaded station selector switch - FORWARD
   a. Loaded station WARN light - ON
3. (P) Nuclear store consent switch - REL/ARM
   a. Loaded station WARN light - OFF
4. Option selector knob - GRD
   a. Loaded station WARN light - FLASHING (doors opening)
   b. Loaded station WARN light - ON (doors open)
5. Delivery mode selector knob - AS REQUIRED
6. Weapon selector knob - NOT RKTS & DISP

Note

When the SUU-21/A dispenser is loaded on the inboard stations, bomb release will not occur if the weapon selector knob is on RKTS & DISP.

BEFORE BOMB RUN (DCU-94/A)

1. Master release lock switch - FORWARD
   a. Loaded station UNLOCKED light - ON
2. Loaded station WARN light - ON

AFTER BOMB RELEASE (DCU-94/A)

Manual Operation

After each bomb release, the dispenser doors remain open and additional switching procedures are unnecessary. With the DIRECT bombing mode selected, the release system (pickle button) is hot. If it is necessary to safe the system between runs, place the master release lock switch AFT, and reselect FWD just prior to the next run.

Automatic Operation

1. At bomb release loaded station WARN light - FLASHING
2. Loaded station WARN light - OFF (doors closed)
3. Option selector knob - SAFE
4. Option selector knob - GRD
   a. Loaded station WARN light - FLASHING
   b. Loaded station WARN light - ON (doors open)

AFTER FINAL BOMB RELEASE (DCU-94/A)

1. (Auto mode) Loaded station WARN light - FLASHING
2. (Auto mode) Loaded station WARN light - OFF (doors closed)
3. Option selector knob - SAFE
   a. (Man. mode) Loaded station WARN light - FLASHING
   b. (Man. mode) Loaded station WARN light - OFF (doors closed)
4. Master release lock switch - AFT
   a. Loaded station UNLOCKED light - OFF
5. Delivery mode selector knob - OFF

WARNING

If the dispenser doors do not close and all bombs have not been expended, the aircraft must be flown to avoid populated areas to the greatest degree practicable.

AFTER LANDING (DCU-94/A)

To open dispenser doors, if required:

1. (P) Nuclear store consent switch - REL/ARM
2. Loaded station selector switch - FORWARD
3. Option selector knob - GRD
   a. Loaded station WARN light - FLASHING
   b. Loaded station WARN light - ON (doors open)
4. All electrical power - REMOVED

Note

All electrical power must be removed from the aircraft before performing steps 5, 6 and 7 to preclude the dispenser doors from closing.

5. Option selector knob - OFF
6. All station selector switches (5) - AFT
7. (P) Nuclear store consent switch - SAFE

SUU-21/A BOMB DISPENSER (MODIFIED)

PREFLIGHT

These procedures consider the employment of SUU-21/A dispensers modified for use with pedestal panel controls and inboard (stations 2 and 8) carriage only.

Refer to part 4, Cockpit Weapons Check and Exterior Inspection (SUU-21/A Dispenser).

INTERIOR INSPECTION

If the dispenser doors are open, close the doors as follows:

1. External power - APPLY
2. Generator switches - EXT ON
3. Armament safety override - DEPRESS
4. Station select button (s) - DEPRESS
   a. Station green light(s) - ON
5. Master arm switch - ARM
   a. Station amber light(s) - ON
6. Arm nose tail switch - NOSE
   a. Station amber light(s) - FLASHING (doors closing)
   b. Station amber light(s) - OFF (doors closed)
7. Station select buttons(s) - OFF
8. Master arm switch - SAFE

WEAPON RELEASE

1. Optical sight - SET
   a. Mode selector - A/G
   b. Reticle depression knob - SET AS REQUIRED
2. Delivery mode selector knob - AS REQUIRED
3. Weapon selector knob - BOMBS
4. Station select button(s) - DEPRESS
5. Master arm switch - ARM
   a. Amber light(s) - ON
6. Arm nose tail switch - NOSE & TAIL
   a. Station amber light - FLASHING (doors opening)
   b. Station amber light - ON (doors open)
7. Bomb button - DEPRESS

AFTER FINAL BOMB RELEASE

1. Arm nose tail switch - NOSE
   a. Station amber light - FLASHING (doors closing)
   b. Station amber light - OUT (doors closed)
2. Master arm switch - SAFE
3. Station select - OFF
4. Delivery mode selector knob - OFF
5. Sight mode selector knob - STBY or CAGE

AFTER LANDING

To Open SUU-21/A Dispenser Doors:

1. Armament safety override button - DEPRESS
2. Station select button(s) - DEPRESS
3. Master arm switch - ON
4. Arm nose tail switch - NOSE & TAIL
   a. Station amber light(s) - FLASHING (doors opening)
   b. Station amber light(s) - ON (doors open)
5. Station select button(s) - OFF
6. Master arm switch - OFF

MODIFIED A/A 37U-15 TOW TARGET SYSTEM (F-4E)

PREFLIGHT

Refer to part 4, figure 2-29.

INFLIGHT

PRE-TAKEOFF

To reduce rolling tendencies immediately after takeoff, the following aileron trim positions are recommended. Trim settings are the same with or without centerline tank.

a. Dart system on station 1, station 9 empty: 2.5 inches left aileron down (trim 2.5 seconds to right of neutral), 1.5 inches right rudder (trim 1.5 seconds to right of neutral).
b. Dart system or station 1, external fuel tank on station 9: 3.5 inches right aileron down (trim 3.5 seconds to left of neutral), 1.0 inch left rudder (trim 1.0 seconds to left of neutral).

Note

The tow target system, carried on the left outboard wing station, may induce 20° to 30° errors in the remote compass transmitter. Due to this effect, the DG mode on the compass controller should be selected.

TAKEOFF

Initiate a slow pitch rotation at 140 KIAS to obtain 8° pitch attitude indicated on the ADI for liftoff at 180 to 190 KIAS. Decrease thrust after gear and flap retraction to ensure that 275 KIAS is not exceeded.

Note

Refer to T.O. 1F-4C-1 External Store Limitations for A/A 37U-15 Tow Target System inflight limitations.

TARGET DEPLOYMENT

1. Select DG mode on compass controller.
2. Delivery mode selector knob - DIRECT
3. Weapon selector knob - BOMBS-SINGLE
4. Station select - LO
   a. Green light - ON
5. Arm nose tail switch - SAFE
6. Master arm switch - ARM
   a. Amber light - ON
7. Bomb Button - DEPRESSED
   Depressing the bomb button deploys the target.

CAUTION

Do not attempt to deploy a damaged dart target. Motion of the damaged target after release is unpredictable. Possible contact with the aircraft could be hazardous.

8. Master arm switch - SAFE
   a. Amber light - OFF

CABLE CUT

1. Master arm switch - ARM
   a. Amber light - ON
2. Tow cable - CUT
   a. (before Rev K) Bomb button - DEPRESS
   b. (after Rev K) Arm nose tail switch - NOSE
3. Chase plane, acknowledge cable cut.

Emergency Cut

1. Arm nose tail sw - NOSE & TAIL or TAIL
2. Chase plane, acknowledge cable cut.

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select - OFF
3. Guns & store switch - NORMAL
4. Sight mode selector knob - STBY or CAGE
5. All DCU-94/A station selector switches (5) - AFT
6. Missile arm switch - SAFE
7. Missile power switch - OFF
8. Missile jett knob - OFF

LANDING WITH STOWED TARGET (DAMAGED OR UNDAMAGED)

1. Flaps - 1/2
2. Angle of attack - 17 to 18 UNITS
   (With wing tank use less than 17 units.)

INFLIGHT PROCEDURES FOR BOMBING RANGE SELECTED WEAPONS (F-4E)

These procedures are included for easy inflight reference to support typical bombing, rocket, and strafe missions on the bomb range. Aircrews are still required to use appropriate checklists for preflight and jettison operations. Only the numbered items need be performed; sub-steps are added for clarity.

INFLIGHT

ROCKET LAUNCHERS AND SUU-20

1. Sight mode selector knob - A/G
2. Reticle depression knob - SET
3. Delivery mode selector knob - DIRECT
4. Intrvl switch - .10 OR .14 ONLY
5. Station select - AS REQUIRED
   a. Green light - ON
6. Weapon selector knob - RKTS & DISP
7. Master arm switch - ARM
   a. Amber light - ON

BOMBS, SUU-20

1. Sight mode selector knob - A/G
2. Reticle depression knob - SET
3. Delivery mode selector knob - AS REQUIRED
4. Intrvl switch - .10 OR .14
5. Station select - AS REQUIRED
   a. Green light - ON
6. Weapon selector knob - BOMBS/SINGLE/RIPPLE/TRIPLE
7. Master arm switch - ARM
   a. Amber light - ON

BOMBS, SUU-21/A (DCU-94/A)

1. Sight mode selector knob - A/G
2. Reticle depression knob - SET
3. Delivery mode selector knob - AS REQUIRED
4. Weapon selector knob - BOMBS
5. Option selector knob - SAFE
6. Loaded station selector switch - FORWARD
   a. Warn light - ON
7. (WSO) Nuclear consent switch- REL/ARM
   a. Warn light - OFF
8. Option selector knob - GRD
   a. WARN light - FLASH
   b. WARN light - ON
9. Master release lock switch - FORWARD
   a. UNLOCKED light - ON

Note

To reopen doors during automatic operation, repeat steps 5 and 8.

AFTER FINAL RELEASE (DCU-94/A)

1. Option selector knob - SAFE
   a. WARN light - FLASH/OFF
2. Master release lock switch - AFT
   a. UNLOCKED light - OFF
3. Loaded station selector switch - AFT
4. (WSO) Nuclear consent switch - SAFE

BOMBS - SUU-21/A MODIFIED

1. Sight mode selector knob - A/G
2. Reticle depression knob - SET
3. Delivery mode selector knob - AS REQUIRED
4. Weapon selector knob - BOMBS
5. Station select button(s) - DEPRESS
6. Master arm switch - ARM
   a. Amber light(s) - ON
7. Arm nose tail switch - NOSE & TAIL
   a. Station amber light(s) - FLASHING (doors opening)
   b. Station amber light(s) - ON (doors open)

To Close Doors

1. Arm nose tail switch - NOSE
   a. Amber light - FLASHING, THEN OFF

STRAFE - SUU-16/A, 23/A, and M61A NOSE GUN

1. Sight mode selector knob - A/G
2. Reticle depression knob - SET
3. Delivery mode selector knob - OFF/DIRECT
4. Station select - AS REQUIRED
   a. Green light - ON
5. Weapon selector knob - GUNS/AS REQUIRED
6. Gun clear switch - AS REQUIRED
7. Guns and stores switch - AS REQUIRED
8. Master arm switch - ARM
   a. Amber light - ON

RANGE DEPARTURE

1. Sight mode selector knob - CAGED, STBY
2. Delivery mode selector knob - OFF
3. Station select - OFF
4. Master arm switch - SAFE

" Figures 2-16 thru 2-20 deleted."

BOMBS & SUU-20 (F-4E) AFTER T.O. 1F-4E-556

PREFLIGHT

Refer to part 4.

INFLIGHT

Note

- There is no cockpit indication to determine that all bombs or rockets have been released or fired from SUU-20 bomb/rocket dispenser. The intervalometers within the SUU-20 cannot be rehomed in flight for an attempt to release or fire a hung bomb or rocket. Do not use an aircraft interval setting of less than 0.100 second when using the SUU-20.

- After T.O. 1F-4-750 (BRU-5/A centerline rack), the following release procedures may be used to release the M118 or MK 84 GP bombs from the CL station. On unmodified aircraft the DCU-94/A procedures may be used.

DIRECT DELIVERY MODE

Bomb Release-Armed

1. Sight mode selector knob - A/G
2. Reticle depression knob - SET
3. Delivery mode selector knob - DIRECT
4. Weapon selector - BOMBS
5. AWRU - SET
   a. Intrvl controls - SET
   b. Qty knob - SET
6. Arm nose tail switch - (ON) AS REQUIRED
7. Station select - LOADED STATION(S)
   a. Green light(s) - ON
8. Master arm switch - ARM
   a. Heads up ARM light - ON
   b. Station ARM light(s) - ON

Note

With the weapon selector in BOMBS, the station ARM (amber) light illuminates only if the arm/nose tail switch is in one of the ON (armed) positions.

9. Bomb button - DEPRESS
   a. Pullup light - ON
   b. When station is empty, station ARM light - OFF

Emergency Bomb Release-Armed

1. AWRU Qty knob - C or S

CAUTION

When selecting either C or S, observe minimum release interval between bombs released from the same aircraft station.

2. Repeat above steps 5 thru 9, hold bomb button depressed 4 seconds.

If all bombs do not release:

3. Weapon selector knob - RKTS & DISP
4. Weapon selector knob - BOMBS
5. Bomb button - DEPRESS (hold 4 seconds).

DIVE TOSS/DIVE LAYDOWN

Before Bomb Run

1. Delivery mode selector knob - DIVE TOSS or DIVE LAY
2. Sight mode selector knob - A/G
   The sight reticle is electrically caged to the radar boresight line and is drift stabilized.
3. HSI mode switches - NAV COMP
   If the HSI indications are to be used, the NAV COMP position must be selected.
4. (WSO) INS mode selector knob - NAV
5. (WSO) Radar mode - AIR-GND
6. (WSO) Radar range - R1 or R2
7. (WSO) Radar power - OPR
   B-sweep, acquisition symbol, and el strobe centered on scope.
8. (WSO) Antenna stab switch - NOR
9. (WSO) WRCS drag coefficient counter - SET (Dive Toss Only)
10. (WSO) WRCS release range counter - SET (Dive Lay Only)
    a. Range switch - NORM or X100
11. (WSO) WRCS release advance - SET (if required)
12. Weapon selector knob - BOMBS
13. AWRU - SET
    a. Intrvl controls - SET
    b. Qty knob - SET
14. Arm nose tail switch - (ON) AS REQUIRED
15. Station select - LOADED STATION(S)
    a. Green light(s) - ON
16. Master arm switch - ARM
    a. Heads up ARM light - ON
    b. Station ARM light(s) - ON

Note

- With the weapon selector in BOMBS, the station ARM (amber) light illuminates only if the arm/nose tail switch is in one of the ON (armed) positions.

- The optical sight and the radar antenna are drift stabilized. Additional upwind correction must be made for the wind effect on the high drag bombs. Wind correction is not required for the low drag bombs (M117 etc.).

Bomb Run

1. (WSO) Receiver gain - MINIMUM
2. (WSO) Lockon target (CALL)

3. Bomb release button - DEPRESS AND HOLD
   a. After bomb release, pullup light - ON
   b. After station is empty, station ARM light - OFF
      During the initial dive toward the target area, the WSO reduces the receiver gain to obtain a single return, depress the action switch to Half Action, place the range strobe in the center of the return, and then depress the action switch to Full Action and release. After lockon, the AC places the pipper on target, depresses and holds the bomb release button, and initiates the desired delivery maneuver. After the bomb is automatically released, the pullup light will illuminate and will go out when the bomb button is released. The station ARM light will go out when the station is empty.

LAYDOWN

Before Bomb Run

1. Delivery mode selector knob - LAYDOWN
2. Sight mode selector knob - A/G
3. Reticle depression knob - SET (if required)
   Set the IP-to-target sight setting.
4. HSI mode switches - NAV COMP
   If the HSI steering information is to be used, the NAV COMP position must be selected.
5. (WSO) INS mode selector knob - NAV
6. (WSO) WRCS target range counter - SET
   Set the distance from IP to target.
7. (WSO) WRCS release range counter - SET
   a. Range switch - NORM or X100
8. (WSO) WRCS release advance counter - SET (if required)
9. Weapon selector knob - BOMBS
10. AWRU - SET
    a. Intrvl controls - SET
    b. Qty knob - SET
11. Arm nose tail switch - (ON) AS REQUIRED
12. Station select - LOADED STATION(S)
    a. Green light(s) - ON
13. Master arm switch - ARM
    a. Heads up ARM light - ON
    b. Station ARM light(s) - ON

Note

With the weapon selector in BOMBS, the station ARM (amber) light illuminates only if the arm/nose tail switch is in one of the ON (armed) positions.

Bomb Run

Approach the target at the preplanned release altitude and airspeed. When the aircraft is directly over the IP, or when the pipper is on target, depress and hold the bomb release button. Maintain a constant airspeed, altitude, and course until the bomb is automatically released. The pullup light will illuminate to indicate bomb release and will go out when the bomb button is released. Wind corrections for the bomb must be applied prior to depressing the bomb button.

1. Bomb release button - DEPRESS AND HOLD
   a. At bomb release, pullup light - ON
   b. When a station is empty, station ARM light - OFF

OFFSET BOMBING/TARGET FIND

Before IP

1. Delivery mode selector knob - OFFSET BOMB or TGT FIND
2. Sight mode selector knob - A/G
   The optical sight reticle is electrically caged to the RBL and to 0° in azimuth. The roll tabs display aircraft attitude until target insert, then steering commands to the target.
3. Navigation mode selector knob - NAV COMP
4. HSI mode switches - NAV COMP
   If the HSI indications are to be used, the NAV COMP position must be selected.
5. (WSO) INS mode selector knob - NAV
6. (WSO) BDHI mode switch - NAV COMP
7. (WSO) Weapon delivery panel - SET
   a. Activate switch - NORMAL
   b. Tgt Find switch - NORMAL
   c. Range switch - AS REQUIRED

Note

The position of the range switch will affect the value placed in the release RANGE readout: times 10 (NORMAL), or times 100.

8. (WSO) WRCS input counters - SET
   a. Target distance N/S - 100-ft increments.
   b. Target distance E/W - 100-ft increments.
   c. IP altitude MSL - 100-ft increments.
   d. Release range - 10-ft or 100-ft increments (Offset bomb)
   e. Release advance - Milliseconds (Offset bomb, if required)
9. Weapon selector knob - BOMBS (Offset bomb)

Note

The ADI will not provide steering if the weapon selector knob is on ARM.

10. AWRU - SET
    a. Intrvl controls - SET
    b. Qty knob - SET
11. Arm nose tail switch - (ON) AS REQUIRED
12. Station select - LOADED STATION(S)
    a. Green light(s) - ON
13. Master arm switch - ARM
    a. Heads up ARM light - ON
    b. Station ARM light(s) - ON

Note

With the weapon selector in BOMBS, the station ARM (amber) light illuminates only if the arm/nose tail switch is in one of the ON (armed) positions.

Bomb Run-Offset Radar IP

1. (WSO) Radar power - OPR
2. (WSO) Radar mode - MAP-PPI
3. (WSO) Antenna stab switch - NOR
4. (WSO) Cursor intensity - ADJUST
5. (WSO) Antenna elevation - ADJUST
6. (WSO) Scan switch - WIDE
7. (WSO) Radar range - R2 or R3
8. (WSO) Operate the along track cursor to position the range cursor over the RIP
9. (WSO) Operate the cross track cursor to position the offset cursor over the RIP.
10. (WSO) Freeze button - PUSH ON

Note

- The along track cursor must be moved first to initiate cursor control. Position the intersection of the cursors over the RIP and then push the freeze button ON; the cursors begin tracking the RIP. The cursors can be moved to touch-up the intersection location over the RIP after the Freeze button is pushed on.

- Do not position the range cursor below zero range. If the range cursor is moved below zero range and then moved out over the IP, the steering information will be in error by 180° even though the cursor responds normally to along track cursor control movements.

11. (WSO) Target insert button - PUSH ON
    The steering instruments display steering commands when the target insert button is pushed ON, and the cursor intersection will position over the target location and track the target. If the target is on the scope, set the target elevation on the ALT RANGE counter and touch-up the cursors over the target.

12. Bomb release button - DEPRESS AND HOLD (Offset bomb)
    a. At bomb release, pullup light - ON
    b. When a station is empty, station ARM light - OFF
       When the aircraft is on course to the target and at the preplanned release altitude and airspeed, depress and hold the bomb release button until the bomb is released, as indicated by illumination of the pullup light.

Note

The roll tabs rotate as the target is passed, and the BDHI and HSI distance-to-target counters will approach zero and then start increasing in value.

Bomb Run-Visual IP Fly-Over

1. (WSO) When over IP, freeze button and target insert button - PUSH ON
   When the aircraft is directly over the IP, the freeze button and the target insert button are pushed ON simultaneously. The steering instruments supply steering commands to the target, and the cursors start tracking the target. If the target is visible on the scope, the WSO may touch-up the cursors when the target elevation is set in the ALT RANGE control.
2. Bomb release button - DEPRESS AND HOLD (Offset bomb)
   a. At bomb release, pullup light - ON
   b. When a station is empty, station ARM light - OFF
      When the aircraft is on course to the target and at the preplanned release altitude and true airspeed, depress and hold the bomb release button until bomb release occurs, indicated by the illumination of the pullup light.

Note

The roll tabs rotate as the target is passed, and the BDHI and HSI distance-to-target counters will approach zero and then start increasing in value.

LABS/OFFSET BOMB/TGT FIND

After Takeoff

1. Delivery mode selector knob - OFFSET BOMB or TGT FIND
2. (WSO) Target find switch - HOLD
   Select HOLD on the weapon delivery panel.
3. Sight mode selector knob - A/G
   The optical sight reticle is electrically caged to the RBL and to 0° in azimuth. The roll tabs display aircraft attitude until target insert, then steering commands to the target.
4. Navigation mode selector knob - NAV COMP
5. HSI mode switches - NAV COMP
   If the HSI indications are to be used, the NAV COMP position must be selected.
6. (WSO) INS mode selector knob - NAV
7. (WSO) BDHI mode switch - NAV COMP
8. (WSO) WRCS input counters - SET
   a. Target distance N/S - 100-ft increments
   b. Target distance E/W - 100-ft increments
   c. IP altitude MSL - 100-ft increments
   d. Release range - 10-ft or 100-ft increments (Offset bomb)
   e. Release range - LABS pullup range, 10-ft or 100-ft increments

Note

The X100 factor is selected through the range switch on the weapon delivery panel.

   f. Release advance - Milliseconds (Offset bomb, if required)
9. Weapon selector knob - BOMBS (Offset bomb)

Note

The ADI will not provide steering if the weapon selector knob is on AGM-45.

10. AWRU - SET
    a. Intrvl controls - SET
    b. Qty knob - SET
11. Arm nose tail switch - (ON) AS REQUIRED
12. Station select - LOADED STATION(S).
    a. Green light(s) - ON
13. Master arm switch - ARM
    a. Heads up ARM light - ON.
    b. Station ARM light(s) - ON

Note

With the weapon selector in BOMBS, the station ARM (amber) light illuminates only if the arm/nose tail switch is in one of the ON (armed) positions.

14. (WSO) Dual timers - SET
    a. Pullup timer - T_1
    b. Release timer - T_2
15. (WSO) Release gyro - SET
    a. Low angle (LOFT) - DEG

Before Bomb Run

1. (WSO) Radar power - OPR
2. (WSO) Radar mode - MAP PPI
3. (WSO) Antenna stab switch - NOR
4. (WSO) Cursor intensity - ADJUST
5. (WSO) Antenna elevation - ADJUST
6. (WSO) Scan switch - WIDE
7. (WSO) Radar range - R2 or R3

Bomb Run-Offset Radar IP

1. (WSO) Operate the along track control to position the range cursor over the RIP.
2. (WSO) Operate the cross track control to position the offset cursor over the RIP.
3. (WSO) Freeze button - PUSH ON

Note

- The along track cursor must be moved first to initiate cursor control. Position the intersection of the cursors over the RIP and then push the freeze button ON; the cursors begin tracking the RIP. The cursors can be moved to touch-up the intersection location over the RIP after the Freeze button is pushed on.

- Do not position the range cursor below zero range. If the range cursor is moved below zero range and then moved out over the IP, the steering information will be in error by 180° even though the cursor responds normally to along track cursor control movements.

4. (WSO) Target insert button - PUSH ON
   The steering instruments display steering commands when the target insert button is pushed ON, and the cursor intersection will position over the target location and track the target. If the target is on the scope, set the target elevation on the ALT RANGE counter and touch-up the cursors over the target.
5. Bomb release button - DEPRESS AND HOLD (Offset bomb)
   a. At bomb release, pullup light - ON
   b. When a station is empty, station ARM light - OFF
   When the aircraft is on course to the target and at the preplanned release altitude and airspeed, depress and hold the bomb release button until the bomb is released, as indicated by illumination of the pullup light.

Note

The roll tabs rotate as the target is passed, and the BDHI and HSI distance-to-target counters will approach zero and then start increasing in value.

Bomb Run Visual IP Fly-Over

1. (WSO) When over IP, freeze button and target insert button - PUSH ON
   When the aircraft is directly over the IP, the freeze button and the target insert button are pushed ON simultaneously. The steering instruments supply steering commands to the target, and the cursors start tracking the target. If the target is visible on the scope, the WSO may touch-up the cursors when the target elevation is set in the ALT RANGE control.
2. Bomb release button - DEPRESS AND HOLD (Offset bomb)
   a. At bomb release, pullup light - ON
   b. When a station is empty, station ARM light - OFF
   When the aircraft is on course to the target and at the preplanned release altitude and true airspeed, depress and hold the bomb release button until bomb release occurs, indicated by the illumination of the pullup

Note

The roll tabs rotate as the target is passed, and the BDHI and HSI distance-to-target counters will approach zero and then start increasing in value.

Bomb Run LABS/TGT Find

1. Delivery mode selector knob (LABS) - AS REQUIRED
   Select the planned delivery mode.

Note

With the TGT find switch on HOLD, the delivery mode selector may be positioned to any LABS mode without losing WRCS function.

2. (WSO) Along track and cross track controls - AS REQUIRED (Visual or Radar IP)

3. (WSO) Freeze control - PUSH ON
4. (WSO) Target Insert control - PUSH ON
5. (WSO) After target insert, activate switch - ON
   Select the ON position only after steering instruments have transitioned to target.
6. At warning tone (T_1 start) - MIL POWER PULLUP
7. Bomb button - DEPRESS AND HOLD

LOFT BOMBING-RIPPLE RELEASE

Before Bomb Run

1. (WSO) Activate switch - NORMAL
   When the WRCS is not used with the LABS modes, the target find switch and/or the activate switch on the weapons delivery panel must be positioned to NORMAL.
2. (WSO) Low angle knob - SET
3. (WSO) Pull up timer - SET
4. (WSO) Release timer - SET ZERO
5. Delivery mode selector knob - LOFT
6. Weapon selector knob - BOMBS
7. AWRU - SET
   a. Intrvl controls - SET
   b. Qty knob - SET
8. Arm nose tail switch - (ON) AS REQUIRED
9. Station select - LOADED STATION(S).
   a. Green light(s) - ON
10. Master arm switch - ARM
    a. Heads up ARM light - ON
    b. Station ARM light(s) - ON

Note

With the weapon selector in BOMBS, the station ARM (amber) light illuminates only if the arm/nose tail switch is in one of the ON (armed) positions.

AT IP

1. Bomb button - DEPRESS AND HOLD
   The bomb button must be energized until the final bomb is released.
2. At pullup point, throttles - FULL MIL POWER

Loft Bomb Delivery

Approach the IP at the preplanned altitude and true airspeed. When over the IP, depress and hold the bomb button energized until the final bomb is released. When the bomb button is depressed, the pullup light will illuminate, the pullup timer will begin, and the ADI pointers will center. Upon completion of the pullup timer, the pullup light and the reticle light will go out and the horizontal pointer will begin programming a 4-G pullup. This is the signal to the AC to select full military power and begin rotation into the pullup maneuver by flying the ADI pointers (4-G pullup) or the accelerometer. Since the sight reticle is pitch stabilized, it will not be in view above loft angles of 20°. When the aircraft attitude is at the preselected release angle, the pullup light and the reticle light illuminate, and the bombs will begin releasing in a ripple sequence. After the final bomb is released, the bomb button is released and the AC initiates a wingover escape maneuver to achieve a 120° turn while diving toward minimum escape altitude. When the bomb button is released, the pullup light will go out and the horizontal pointer will move out of view.

After Escape Maneuver

1. Master arm switch - SAFE
2. Station select (5) - OFF
3. Delivery mode selector knob - OFF
   Placing the delivery mode selector knob to OFF removes power from the bombing timers.

CENTERLINE WEAPON RELEASE (DCU-94/A)

Before Bomb Run

1. Delivery mode selector knob - DIRECT or AS REQUIRED
2. Optical sight - SET (if required)
3. (WSO) Nuclear store consent switch - REL/ARM
4. DCU-94/A CL station selector switch - FORWARD
5. Arm nose tail switch - (ON) AS REQUIRED

Bomb Run

1. DCU-94/A master release lock switch - FORWARD
   a. CL UNLOCKED light - ON
2. Master arm switch - ARM
   a. Heads up ARM light - ON
   The master arm switch allows power to the arm nose tail switch.
3. Delivery maneuver - EXECUTE
   If the DIRECT delivery mode is selected, the bomb is released when the bomb button is depressed.

Note

If the bomb does not release, recheck switch positions, select the DIRECT release mode and depress bomb button, or energize the nuclear store jettison control.

POST STRIKE

Before Landing

1. Master arm switch - SAFE
2. Station select - OFF
3. Delivery mode selector knob - OFF
4. Radar missile power switch - OFF
5. Selective jettison knob - OFF
6. All DCU-94/A station select switches (5) - AFT
7. Sight mode selector knob - STBY or CAGE

Armament Area (De-Arming)

1. Armament switches - OFF/SAFE/NORMAL
2. Aircrew - HANDS IN VIEW

ROCKETS & SUU-20(F-4E) AFTER T.O. 1F-4E-556

PREFLIGHT

Refer to part 4.

INFLIGHT

Note

There is no cockpit indication to determine that all bombs or rockets have been released or fired from SUU-20 bomb/rocket dispenser. The intervalometers within the SUU-20 cannot be rehomed in flight for an attempt to release or fire a hung bomb or rocket. Do not use an aircraft interval setting of less than 0.100 second when using the SUU-20.

ROCKET FIRING

1. Sight mode selector knob - A/G
2. Reticle depression knob - SET
3. Delivery mode selector knob - DIRECT
4. Weapon selector knob - RKTS & DISP or A
5. With RKTS & DISP selected, AWRU - SET
   a. Intrvl controls - SET
   b. Qty knob - SET
6. Station select - LOADED STATION(S)
   a. Green light(s) - ON
7. Master arm switch - ARM
   a. Heads up ARM light - ON
   b. Station ARM light(s) - ON
8. Bomb button - DEPRESS

LAUNCHER RELEASE (EXCEPT SUU-20)

1. Delivery mode selector knob - DIRECT
2. Weapon selector knob - BOMBS
3. AWRU - SET
   a. Intrvl controls - SET
   b. Qty knob - C or S
4. Arm nose tail switch - NOT IN SAFE
   With weapon selector knob in BOMBS, the arm nose tail switch must be out of SAFE to obtain the station ARM light on.
5. Station select - LOADED STATION(S)
   a. Green light(s) - ON
6. Master arm switch - ARM
   a. Heads up ARM light - ON
   b. Station ARM light(s) - ON
7. Bomb button - DEPRESS (hold 4 seconds)
   a. Pullup light - ON
   b. When station is empty, station ARM light - OFF

If all launchers do not release:

8. Weapon selector knob - RKTS & DISP
9. Weapon selector knob - BOMBS
10. Bomb button - DEPRESS (hold 4 seconds)

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select - OFF
3. Delivery mode selector knob - OFF
4. Radar missile power switch - OFF
5. Selective jettison knob - OFF
6. All DCU-94/A station select switches (5) - AFT
7. Sight mode selector knob - STBY or CAGE

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF/SAFE/NORMAL
2. Aircrew - HANDS IN VIEW

CBU AND FLARE DISPENSERS (F-4E) AFTER T.O. 1F-4E-556

PREFLIGHT

Refer to part 4.

INFLIGHT

DIRECT DELIVERY MODE

Dispensing

1. Sight mode selector knob - A/G
2. Reticle depression knob - SET
3. Delivery mode selector knob - DIRECT
4. Weapon selector knob - RKTS & DISP or A
5. With RKTS & DISP selected, AWRU - SET
   a. Intrvl controls - SET
   b. Qty knob - SET
6. Station select - LOADED STATION(S)
   a. Green light(s) - ON
7. Master arm switch - ARM
   a. Station ARM light(s) - ON
   b. Heads up ARM light - ON
8. Bomb button - DEPRESS AND HOLD AS REQUIRED
9. (SUU-7) Station ARM lights - MONITOR
   a. Blinking light - Tubes Remaining
   b. Station ARM light out - All tubes have received a firing pulse.

Note

The Station ARM lights will not monitor the empty status of the flare dispenser, SUU-38, SUU-42. The station ARM light normally goes out when all SUU-13's on that station have timed out.

Dispenser Release

1. Delivery mode selector knob - DIRECT
2. Weapon selector knob - BOMBS
3. AWRU - SET
   a. Intrvl controls - SET
   b. Qty knob - C or S
4. Arm nose tail switch - NOT IN SAFE
   With weapon selector knob in BOMBS, the arm nose tail switch must be out of SAFE to obtain the station ARM light on.
5. Station select - LOADED STATION(S)
   a. Green light(s) - ON
6. Master arm switch - ARM
   a. Heads up ARM light - ON
   b. Station ARM light(s) - ON
7. Bomb button - DEPRESS (hold 4 seconds)
   a. Pullup light - ON
   b. When station is empty, station ARM light - OFF

If all dispensers do not release:

8. Weapon selector knob - RKTS & DISP
9. Weapon selector knob - BOMBS
10. Bomb button - DEPRESS (hold 4 seconds)

DIVE LAYDOWN

Before Bomb Run

1. Delivery mode selector knob - DIVE LAY
2. Sight mode selector knob - A/G
   The sight reticle is electrically caged to the radar boresight line and is drift stabilized.
3. HSI mode switches - NAV COMP
   If the HSI indications are to be used, the NAV COMP position must be selected.
4. (WSO) INS mode selector knob - NAV
5. (WSO) Radar mode - AIR-GND
6. (WSO) Radar range - R1 or R2
7. (WSO) Radar power - OPR
   B-sweep, acquisition symbol, and el strobe centered on scope.
8. (WSO) Antenna stab switch - NOR
9. (WSO) WRCS release range counter - SET
   a. Range switch - NORM or X100
10. (WSO) WRCS release advance - SET (if required)
11. Weapon selector knob - RKTS & DISP or A
12. With RKTS & DISP selected, AWRU - SET
    a. Intrvl controls - SET
    b. Qty knob - SET
13. Station select - LOADED STATION(S)
    a. Green light(s) - ON
14. Master arm switch -ARM
    a. Station ARM light(s) - ON
    b. Heads up ARM light - ON

Bomb Run

Note

The optical sight and the radar antenna are drift stabilized. Upwind correction must be made for the wind effect on the high drag bombs. Wind correction is not required for the low drag bombs (M117, MK 82 LDGP, etc.).

1. (WSO) Receiver gain - MINIMUM
2. (WSO) Lockon target
3. Bomb release button - DEPRESS AND HOLD
4. (SUU-7) Station ARM lights - MONITOR
   a. Blinking light - Tubes remaining
   b. Station ARM light out - All tubes have received a firing pulse.

Note

- The station ARM lights do not monitor the empty status of the flare dispenser SUU-38, SUU-42. The station ARM light normally goes out when all SUU-13's on that station have timed out.
- During the initial dive toward the target area, the WSO reduces the receiver gain to obtain a single return, depress the action switch to Half-Action, place the range strobe in the center of the return, and then depress the action switch to Full-Action and release. After lockon, the AC places the pipper on target, depresses and holds the bomb release button, and initiates the desired delivery maneuver. After the bomb is automatically released, the pullup light will illuminate and will go out when the bomb button is released.

LAYDOWN

Before Bomb Run

1. Delivery mode selector knob - LAYDOWN
2. Sight mode selector knob - A/G
3. Reticle depression knob - SET (if required)
   Set the IP-to-target sight setting.
4. HSI mode switches - NAV COMP
   If the HSI steering information is to be used, the NAV COMP position must be selected.
5. (WSO) INS mode selector knob - NAV
6. (WSO) WRCS target range counter - SET
   Set the distance from IP to target.
7. (WSO) WRCS release range counter - SET
   a. Range switch NORM or X100
8. (WSO) WRCS release advance counter - SET (if required)
9. Weapon selector knob - RKTS & DISP or A
10. With RKTS & DISP selected, AWRU - SET
    a. Intrvl controls - SET
    b. Qty knob - SET
11. Station select - LOADED STATION(S)
    a. Green light(s) - ON
12. Master arm switch - ARM
    a. Station ARM light(s) - ON
    b. Heads up ARM light - ON

Bomb Run

Approach the target at the preplanned release altitude and airspeed. When the aircraft is directly over the IP, or when the pipper is on target, depress and hold the bomb release button. Maintain a constant airspeed, altitude, and course until the bomb is automatically released. The pullup light will illuminate to indicate bomb release and will go out when the bomb button is released. Wind corrections for the bomb must be applied prior to depressing the bomb button.

1. Bomb release button - DEPRESS AND HOLD
2. (SUU-7) Station ARM lights - MONITOR
   a. Blinking light - Tubes remaining
   b. Station ARM light out - All tubes have received a firing pulse.

Note

The station ARM lights will not monitor the empty status of the flare dispenser SUU-38, SUU-42. The station ARM light normally goes out when all SUU-13's on that station have timed out.

OFFSET BOMBING/TARGET FIND

Before IP

1. Delivery mode selector knob - OFFSET BOMB or TGT FIND
2. Sight mode selector knob - A/G
   The optical sight reticle is electrically caged to the RBL and to 0° in azimuth. The roll tabs display aircraft attitude until target insert, then steering commands to the target.
3. Navigation mode selector knob - NAV COMP
4. HSI mode switches - NAV COMP
   If the HSI indications are to be used, the NAV COMP position must be selected.
5. (WSO) INS mode selector knob - NAV
6. (WSO) BDHI mode switch - NAV COMP
7. (WSO) Weapon delivery panel - SET
   a. Activate switch - NORMAL
   b. Tgt find switch - NORMAL
   c. Range switch - AS REQUIRED
8. (WSO) WRCS input counters - SET
   a. Target distance N/S - 100-ft increments
   b. Target distance E/W - 100-ft increments
   c. IP altitude MSL - 100-ft increments
   d. Release range - 10-ft or 100-ft increments (Offset bomb)
   e. Release advance - Milliseconds (Offset bomb, if required)
9. Weapon selector knob - RKTS & DISP or A
10. With RKTS & DISP selected, AWRU - SET
    a. Intrvl controls - SET
    b. Qty knob - SET
11. Station select - LOADED STATION(S)
    a. Green light(s) - ON
12. Master arm switch - ARM
    a. Station ARM light(s) - ON
    b. Heads up ARM light - ON

Note

The ADI will not provide steering if the weapon selector knob is on ARM.

Bomb Run-Offset Radar IP

1. (WSO) Radar power - OPR
2. (WSO) Radar mode - MAP-PPI
3. (WSO) Antenna stab switch - NOR
4. (WSO) Cursor intensity - ADJUST
5. (WSO) Antenna elevation - ADJUST
6. (WSO) Scan switch - WIDE
7. (WSO) Radar range - R2 or R3
8. (WSO) Operate the along track cursor to position the range cursor over the RIP.
9. (WSO) Operate the cross track cursor to position the offset cursor over the RIP.
10. (WSO) Freeze button - PUSH ON

Note

- The along track cursor must be moved first to initiate cursor control. Position the intersection of the cursors over the RIP and then push the freeze button ON; the cursors begin tracking the RIP. The cursors can be moved to touch-up the intersection location over the RIP after the Freeze button is pushed on.
- Do not position the range cursor below zero range. If the range cursor is moved below zero range and then moved out over the IP, the steering information will be in error by 180° even though the cursor responds normally to along track cursor control movements.

11. (WSO) Target insert button - PUSH ON
    The steering instruments display steering commands when the target insert button is pushed ON, and the cursor intersection will position over the target location and track the target. If the target is on the scope, set the target elevation on the ALT RANGE counter and touch-up the cursors over the target.
12. Bomb release button - DEPRESS AND HOLD (Offset bomb)
    When the aircraft is on course to the target and at a preplanned release altitude and airspeed, depress and hold the bomb release button until the dispenser selected is empty.

Note

The roll tabs rotate as the target is passed, and the BDHI and HSI distance-to-target counters will approach zero and then start increasing in value.

13. (SUU-7) Station ARM lights - MONITOR
    a. Blinking light - Tubes remaining.
    b. Station ARM light out - All tubes have received a firing pulse.

Note

The station ARM lights will not monitor the empty status of the flare dispenser SUU-38, SUU-42. The station ARM light normally goes out when all SUU-13's on that station have timed out.

Bomb Run-Visual IP Fly-Over

1. (WSO) When over IP, freeze button and target insert button - PUSH ON
   When the aircraft is directly over the IP, the freeze button and the target insert button are pushed ON simultaneously. The steering instruments supply steering commands to the target, and the cursors position and start tracking the target. If the target is visible on the scope, the WSO may touch-up the cursors when the target elevation is set in the ALT RANGE control.
2. Bomb release button - DEPRESS AND HOLD (Offset bomb)
   When the aircraft is on course to the target and at a preplanned release altitude and true airspeed, depress and hold the bomb release button until the dispenser selected is empty.

Note

The roll tabs rotate as the target is passed, and the BDHI and HSI distance-to-target counters will approach zero and then start increasing in value.

3. (SUU-7) Station ARM lights - MONITOR
   a. Blinking light - Tubes remaining
   b. Station ARM light out - All tubes have received a firing pulse.

Note

The station ARM lights will not monitor the empty status of the flare dispenser SUU-38, SUU-42. The station ARM light normally goes out when all SUU-13's on the station have timed out.

POST STRIKE

Before Landing

1. Master arm switch - SAFE
2. Station select - OFF
3. Delivery mode selector knob - OFF
4. Radar missile power switch - OFF
5. Selective jettison knob - OFF
6. All DCU-94/A station select switches (5) - AFT
7. Sight mode selector knob - STBY or CAGE

Armament Area (De-Arming)

1. Armament switches - OFF/SAFE/NORMAL
2. Aircrew - HANDS IN VIEW

A/B 45Y-1, Y-2, Y-4 SPRAY TANK DISPENSERS (F-4E) AFTER T.O. 1F-4E-556

PREFLIGHT

Refer to part 4.

INFLIGHT

DISPENSING

1. Delivery mode selector knob - DIRECT
2. Station select - LOADED STATIONS
   a. Green light - ON
3. Weapon selector knob - A
4. Arm nose tail switch - NOSE & TAIL
5. Master arm switch - ARM
   a. Station ARM light - ON
   b. Heads up ARM light - ON

Note

Placing the master arm switch to ARM arms the A/B 45Y-1 tank causing an explosive squib to discharge, thereby pressurizing the bladder of liquid.

WARNING

Once the A/B 45Y-1 is armed, it cannot be dearmed and therefore must not be brought back to base.

Note

- On the A/B 45Y-2 dry agent spray tank, energizing the master arm switch causes the agent container to be pressurized by ram air for proper dissemination. The Y-2 tank can be dearmed by positioning the master arm switch to SAFE.
- On the A/B 45Y-4 dry agent spray tank, energizing the master arm switch arms the tank. The Y-4 tank can be dearmed by positioning the master arm switch to SAFE.

6. Bomb button - DEPRESSED
7. Station ARM light - MONITOR
   a. Blinking station ARM light - spray remaining
   b. Station ARM light out - no spray remaining

DISPENSER RELEASE

1. Station select - LOADED STATION(S)
   a. Green light - ON
2. Selective jettison knob - STORES
3. Selective jettison button - PUSH

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select - OFF
3. Delivery mode selector knob - OFF
4. Radar missile power switch - OFF
5. Selective jettison knob - OFF
6. All DCU-94/A station select switches (5) - AFT
7. Sight mode selector knob - STBY or CAGE

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF/SAFE/NORMAL
2. Aircrew - HANDS IN VIEW

TMU-28/B SPRAY TANK (F-4E) AFTER T.O. 1F-4E-556

PREFLIGHT

Refer to part 4.

INFLIGHT

1. Weapon selector knob - B or C (Not in RKTS & DISP or A)
2. Arm nose tail switch - SAFE
3. Master arm switch - SAFE
   a. Heads up ARM light - OFF

DISPENSING

1. Delivery mode selector knob - DIRECT
2. Station select - LOADED STATION(S)
   a. Green light(s) - ON
3. Master arm switch - ARM
   a. Station ARM light(s) - OFF
   b. Heads up ARM light - ON
4. To extend boom, weapon selector knob - A
   a. While boom is extending, station ARM light(s) - ON STEADY
   b. Boom fully extended, amber light(s) - BLINKING
5. To begin dispensing, bomb button - DEPRESS AND HOLD (8 sec)
6. To stop dispensing, bomb button - RELEASE
7. Weapon selector knob - B or C (Not in RKTS & DISP or A)
8. To retract boom, arm nose tail switch - NOSE & TAIL
   a. Station ARM light continues to blink after boom is retracted.

Note

The Station ARM light will continue to blink until power is removed from the aircraft, except when the station selector button is pushed off. When the station selector button is pushed on, the light will begin blinking again.

9. Station select - PUSH OFF
   a. Green light(s) - OFF
   b. Station ARM light(s) - OFF
10. Delivery mode selector knob - OFF
11. Master arm switch - SAFE
    a. Heads up ARM light - OFF

DISPENSER RELEASE

1. Station select - LOADED STATION(S)
   a. Green light(s) - ON
2. Selective jettison knob - STORES
3. Selective jettison button - PUSH

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select - OFF
3. Delivery mode selector knob - OFF
4. Radar missile power switch - OFF
5. Selective jettison knob - OFF
6. All DCU-94/A station select switches (5) - AFT
7. Sight mode selector knob - STBY or CAGE

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF/SAFE/NORMAL
2. Aircrew - HANDS IN VIEW

PAU-7/A SPRAY TANK (F-4E) AFTER T.O. 1F-4E-556

PREFLIGHT

Refer to part 4.

INFLIGHT

1. Weapon selector knob - B or C (Not in RKTS & DISP or A)
2. Arm nose tail switch - SAFE
3. Master arm switch - SAFE

DISPENSING

1. Delivery mode selector knob - DIRECT
2. Weapon selector knob - A
3. Station select - LOADED STATION(S)
   a. Green light(s) - ON
4. Master arm switch - ARM
   a. Heads up ARM light - ON
5. To extend boom, arm nose tail switch - NOSE & TAIL
6. To dispense, bomb button - DEPRESS & HOLD
   Tank will dispense with boom up or down.
7. To stop dispensing, bomb button - RELEASE
8. To retract boom, arm nose tail switch - TAIL (90 sec)
9. Station select - PUSH OFF (after boom retract)
   a. Green light(s) - OFF
10. Delivery mode selector knob - OFF
11. Master arm switch - SAFE
    a. Heads up ARM light - OFF

DISPENSER RELEASE

1. Station select - LOADED STATION(S)
   a. Green light(s) - ON
2. Selective jettison knob - STORES
3. Selective jettison button - PUSH

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select - OFF
3. Delivery mode selector knob - OFF
4. Radar missile power switch - OFF
5. Selective jettison knob - OFF
6. All DCU-94/A station select switches (5) - AFT
7. Sight mode selector knob - STBY or CAGE

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF/SAFE/NORMAL
2. Aircrew - HANDS IN VIEW

SUU-16/A, -23/A GUN POD (F-4E) AFTER T.O. 1F-4E-556

PREFLIGHT

Refer to part 4.

INFLIGHT

1. Sight mode selector knob - A/G (or A/A unless CAGE is present)
2. Reticle depression knob - SET (A/G only)
3. Gun clear switch - NONCLEAR or AUTO CLEAR
4. Delivery mode selector knob - OFF or DIRECT

Note

- If the optical sight is to be used for air-to-ground guns, the OFF or DIRECT position should be selected on the delivery mode selector panel.
- Reference to the RAT (ram air turbine) is applicable to the SUU-16/A gun pod only.

5. Weapon selector knob - NOT TV or ARM (unless CAGE is present)
6. Wing station select - LOADED STATION(S)
   a. Green light(s) - ON (SUU-23 prestart)
7. Guns/Missiles select switch - GUNS
   a. Heads up GUN light - ON
8. Master arm switch - ARM
   a. Heads up GUN light - OFF
   b. Heads up ARM light - ON
   c. Station ARM light(s) - ON (SUU-16, RAT OUT)
      The SUU-16 RAT is deployed when master arm is placed to ARM.
9. Trigger switch - ACTUATE
   a. Zero rounds remaining, station ARM light - OFF

FINAL BURST SAFE GUNS

(Rounds Remaining)

1. Gun clear switch - AUTO CLEAR
2. Trigger switch - ACTUATE
3. Station select - PUSH OFF
   a. Green light(s) - OFF
   b. Station ARM light(s) - OFF (SUU-16, RAT IN)
      The SUU-16 RAT will retract when the station selector button is pushed OFF.
4. Master arm switch - SAFE
   a. Heads up ARM light - OFF

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select - OFF
3. Delivery mode selector knob - OFF
4. Radar missile power switch - OFF
5. Selective jettison knob - OFF
6. All DCU-94/A station select switches (5) - AFT
7. Sight mode selector knob - STBY or CAGE

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF/SAFE/NORMAL
2. Aircrew - HANDS IN VIEW

M61A1 NOSE GUN (F-4E) AFTER T.O. 1F-4E-556

PREFLIGHT

Refer to part 4.

EXTERIOR INSPECTION

(Not Applicable)

INFLIGHT

1. Sight mode selector knob - A/G (or A/A unless CAGE is present)
2. Reticle depression knob - SET (A/G only)
3. Rate switch - HIGH/LOW
4. Rounds counter - SET
5. Delivery mode selector knob - OFF or DIRECT

Note

If the optical sight is to be used for air-to-ground guns, the OFF or DIRECT position should be selected on the delivery mode selector panel.

6. Weapon selector knob - NOT TV or ARM (unless CAGE is present)
7. GUN station select - PUSH ON
   a. Green GUN station light - ON
8. Guns/Missiles select switch - GUNS
   a. Heads up GUN light - ON
9. Master arm switch - ARM
   a. Heads up GUN light - REMAINS ON
   b. Heads up ARM light - ON
   c. Gun station ARM light - ON
10. Trigger switch - ACTUATE
    a. Zero rounds remaining, station ARM light - OFF

SAFE GUNS

1. GUN station select - PUSH OFF
   a. Green GUN station light - OFF
   b. Gun station ARM light - OFF
2. Master arm switch - SAFE
   a. Heads up ARM light - OFF

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select - OFF
3. Delivery mode selector knob - OFF
4. Radar missile power switch - OFF
5. Selective jettison knob - OFF
6. All DCU-94/A station select switches (5) - AFT
7. Sight mode selector knob - STBY or CAGE

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF/SAFE/NORMAL
2. Aircrew - HANDS IN VIEW

AGM-12B, C, E MISSILES (F-4E) AFTER T.O. 1F-4E-556

PREFLIGHT

Refer to part 4.

INFLIGHT

TRANSMITTER CHECK

Perform an airborne check as follows:

1. Delivery mode selector knob - DIRECT
2. Station select - OFF
   a. Green lights - OFF
3. Warning lights test sw - TEST
   a. Station green lights - ON
   b. Station ARM lights - ON
4. Weapon selector knob - AGM-12
5. Master arm switch - ARM
   a. Heads up ARM light - ON
   b. All station ARM lights - OFF
6. Bomb button - DEPRESS
7. Control handle - TRANSMIT COMMANDS
   The transmitter timer is energized for 50 ± 10 seconds.
8. Master arm switch - SAFE

BEFORE MISSILE LAUNCH

1. (AC, WSO) Oxygen diluter selector - 100 PERCENT
2. Weapon selector knob - AGM-12
3. Station select - PUSH ON
   a. Green light - ON

MISSILE LAUNCH

1. Master arm switch - ARM
   a. Heads up ARM light - ON
   b. Station ARM light - ON
2. Bomb button - DEPRESS (2 sec approx)
   Depress and hold the bomb button until the missile fires or until the launch is aborted due to missile malfunction.
   a. Station ARM light - OFF

To immediately arm a second missile for re-attack:

3. Station select (just fired) - PUSH OFF
   a. Green light - OFF
4. Station select (next missile) - PUSH ON
   a. Green light - ON
   b. Station ARM light - ON

MISSILE FIGHT (AGM-12E)

To prevent AGM-12E warhead from functioning

1. (WSO) Armament power circuit breaker - PULL (No. 1 panel)
   If it is necessary to safe the missile, pull circuit breaker.

AFTER MISSILE ATTACK

1. Armament switches - OFF/SAFE/NORMAL
   a. Master arm switch - SAFE
   b. Station selector buttons - OFF
2. Emergency vent handle - CYCLE
   Pull to de-pressurize, then push to pressurize to cycle cockpit air in case of contamination by missile exhaust gases.

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select - OFF
3. Delivery mode selector knob - OFF
4. Radar missile power switch - OFF
5. Selective jettison knob - OFF
6. All DCU-94/A station select switches (5) - AFT
7. Sight mode selector knob - STBY or CAGE

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF/SAFE/NORMAL
2. Aircrew - HANDS IN VIEW

SUU-21/A BOMB DISPENSER (MODIFIED) AFTER T.O. 1F-4E-556

PREFLIGHT

These procedures consider the employment of SUU-21/A dispensers modified for use with pedestal panel controls and inboard (stations 2 and 8) carriage only:

Refer to part 4, Cockpit Weapons Check and Exterior Inspection (SUU-21/A Dispenser).

INTERIOR INSPECTION

If the dispenser doors are open, close the doors as follows:

1. External power - APPLY
2. Generator switches - EXT ON
3. Armament safety override - DEPRESS
4. Station select - LOADED STATION
   a. Green light - ON
5. Master arm switch - ARM
   a. Heads up ARM light - ON
   b. Station ARM light - ON
6. Arm nose tail switch - NOSE
   a. Station ARM light - FLASHING (doors closing)
   b. Station ARM light - OFF (doors closed)
7. Station select - OFF
   a. Green light - OFF
8. Master arm switch - SAFE
   a. Heads up ARM light - OFF

BOMB RELEASE

1. Sight mode selector knob - A/G
2. Reticle depression knob - SET
3. Delivery mode selector knob - DIRECT
4. Weapon selector knob - BOMBS
5. AWRU - SET
   a. Intrvl controls - (Not applicable)
   b. Qty knob - 1
6. Station select - LOADED STATION
   a. Green light - ON
7. Master arm switch - ARM
   a. Station ARM light - OFF
   b. Heads up ARM light - ON
8. Arm nose tail switch - NOSE & TAIL
   a. Station ARM light - FLASHING (doors opening)
   b. Station ARM light - ON (doors open)
9. Bomb button - DEPRESS

AFTER FINAL BOMB RELEASE

1. Arm nose tail switch - NOSE
   a. Station ARM light - FLASHING (doors closing)
   b. Station ARM light - OUT (doors closed)
2. Master arm switch - SAFE
   a. Heads up ARM light - OFF
3. Station select - OFF
   a. Station green light - OFF
4. Delivery mode selector knob - OFF
5. Sight mode selector knob - STBY or CAGE

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select - OFF
3. Delivery mode selector knob - OFF
4. Radar missile power switch - OFF
5. Selective jettison knob - OFF
6. All DCU-94/A station select switches (5) - AFT
7. Sight mode selector knob - STBY or CAGE

AFTER LANDING ARMAMENT AREA (DE-ARMING)

To Open SUU-21/A Dispenser Doors:

1. Armament safety override button - DEPRESS
2. Station select - LOADED
   a. Station green light - ON
3. Master arm switch - ON
   a. Heads up ARM light - ON
   b. Station ARM light - ON
4. Arm nose tail switch - NOSE & TAIL
   a. Station ARM light - FLASHING (doors opening
   b. Station ARM light - ON (doors open)
5. Station select - OFF
   a. Station green light - OFF
6. Master arm switch - OFF
   a. Head up ARM light - OFF
7. Armament switches - OFF/SAFE/NORMAL
8. Aircrew - HANDS IN VIEW

MODIFIED A/A 37U-15 TOW TARGET SYSTEM (F-4E) AFTER T.O. 1F-4E-556

PREFLIGHT

Refer to part 4.

INFLIGHT

PRE-TAKEOFF

To reduce rolling tendencies immediately after takeoff, the following aileron trim positions are recommended. Trim settings are the same with or without centerline tank.

a. Dart system on station 1, station 9 empty: 2.5 inches left aileron down (trim 2.5 seconds to right of neutral), 1.5 inches right rudder (trim 1.5 seconds to right of neutral).
b. Dart system on station 1, external fuel tank on station 9: 3.5 inches right aileron down (trim 3.5 seconds to left of neutral), 1.0 inch left rudder (trim 1.0 seconds to left of neutral).

Note

The tow target system, carried on the left outboard wing station, may induce 20° to 30° errors in the remote compass transmitter. Due to this effect, the DG mode on the compass controller should be selected.

TAKEOFF

Initiate a slow pitch rotation at 140 KIAS to obtain 8° pitch attitude indicated on the ADI for liftoff at 180 to 190 KIAS. Decrease thrust after gear and flap retraction to ensure that 275 KIAS is not exceeded.

Note

Refer to T.O. 1F-4C-1 External Store Limitations for A/A 37U-15 Tow Target System inflight limitations.

TARGET DEPLOYMENT

1. Delivery mode selector knob - DIRECT
2. Weapon select - A
3. Station select - LO
   a. LO green light - ON
4. Arm nose tail switch - SAFE
5. Master arm switch - ARM
   a. Head-up ARM light - ON
   b. Station ARM light - ON
6. Bomb button - DEPRESSED
   Depressing the bomb button once deploys the the target.

CAUTION

Do not attempt to deploy a damaged dart target. Motion of the damaged target after release is unpredictable. Possible contact with the aircraft could be hazardous.

7. Master arm switch - SAFE
   a. ARM lights - OFF

CABLE CUT

1. Master arm switch - ARM
   a. Head-up ARM light - ON
   b. Station ARM light - ON
2. Tow cable - CUT
   a. (before Rev K) Bomb button - DEPRESS
   b. (after Rev K) Arm nose tail switch - NOSE
3. Chase plane, acknowledge cable cut

Emergency Cut

1. If cable does not cut, arm nose tail switch - NOSE and TAIL or TAIL
2. Chase plane, acknowledge cable cut

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select - OFF
3. Delivery mode selector knob - OFF
4. Radar missile power switch - OFF
5. Selective jettison knob - OFF
6. All DCU-94/A station select switches (5) - AFT
7. Sight mode selector knob - STBY or CAGE

LANDING WITH STOWED TARGET (DAMAGED OR UNDAMAGED)

1. Flaps - 1/2
2. Angle of attack - 17 to 18 UNITS
   (With wing tank use less than 17 units).

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF/SAFE/NORMAL
2. Aircrew - HANDS IN VIEW

INFLIGHT PROCEDURES FOR BOMBING RANGE SELECTED WEAPONS (F-4E) AFTER T.O. 1F-4E-556

These procedures are included for easy inflight reference to support typical bombing, rocket, and strafe missions on the bomb range. Aircrews are still required to use appropriate checklists for preflight and jettison operations. Only the numbered items need be performed; sub-steps are added for clarity.

INFLIGHT

ROCKET LAUNCHERS AND SUU-20

1. Sight mode selector knob - A/G
2. Reticle depression knob - SET
3. Delivery mode selector knob - DIRECT
4. Weapon select - RKTS & DISP or A
5. With RKTS & DISP selected, AWRU - SET
   a. Intrvl controls - SET
   b. Qty knob - SET
6. Station select - LOADED STATION(S)
   a. Green light(s) - ON
7. Master arm switch - ARM
   a. Station ARM light(s) - ON
   b. Heads up ARM light - ON
8. Bomb button - DEPRESS

BOMBS, SUU-20

Note

There is no cockpit indication to determine that all bombs or rockets have been released or fired from SUU-20 bomb/rocket dispenser. The intervalometers within the SUU-20 cannot be rehomed in flight for an attempt to release or fire a hung bomb or rocket. Do not use an aircraft interval setting of less than 0.100 second when using the SUU-20.

1. Sight mode selector knob - A/G
2. Reticle depression knob - SET
3. Delivery mode selector knob - DIRECT
4. Weapon selector knob - BOMBS
5. AWRU - SET
   a. Intrvl controls - SET
   b. Qty knob - SET
6. Arm nose tail switch - AS REQUIRED
   With weapon selector knob in BOMBS, the arm nose tail switch must be out of SAFE to obtain the station ARM light.
7. Station select - LOADED STATION(S).
   a. Green light(s) - ON
8. Master arm switch - ARM
   a. Station ARM light(s) - ON
   b. Heads up ARM light - ON.
9. Bomb button - DEPRESS

BOMBS, SUU-21/A (DCU-94/A)

1. Sight mode selector knob - A/G
2. Reticle depression knob - SET
3. Delivery mode selector knob - AS REQUIRED
4. Weapon selector knob - BOMBS
5. Option selector knob - SAFE
6. Loaded station selector switch - FORWARD
   a. WARN light - ON
7. (WSO) Nuclear consent switch - REL/ARM
   a. WARN light - OFF
8. Option selector knob - GRD
   a. WARN light - FLASH
   b. WARN light - ON
9. Master release lock switch - FORWARD
   a. UNLOCKED light - ON
10. Bomb button - DEPRESS

Note

To reopen doors during automatic operation, repeat steps 5 and 8.

After Final Release (DCU-94/A)

1. Option selector knob - SAFE
   a. WARN light - FLASH/OFF
2. Master release lock switch - AFT
   a. UNLOCKED light - OFF
3. Loaded station selector switch - AFT
4. (WSO) Nuclear consent switch - SAFE

BOMBS-SUU-21/A MODIFIED

1. Sight mode selector knob - A/G
2. Reticle depression knob - SET
3. Delivery mode selector knob - DIRECT
4. Weapon selector knob - BOMBS
5. AWRU - SET
   a. Intrvl controls - (Not applicable)
   b. Qty knob - 1
6. Station select - LOADED STATION(S).
   a. Green light(s) - ON
7. Master arm switch - ARM
   a. Station ARM light(s) - OFF
   b. Heads up ARM light - ON
8. Arm nose tail switch - NOSE & TAIL
   a. Station ARM light - FLASHING (doors opening)
   b. Station ARM light - ON (doors open)
9. Bomb button - DEPRESS

To Close Doors

1. Arm nose tail switch - NOSE
   a. Station ARM light - FLASHING, THEN OFF

STRAFE-SUU-16/A, 23/A, AND M61A NOSE GUN

1. Sight mode selector knob - A/G
2. Reticle depression knob - SET
3. (Nose Gun) Rate switch - HIGH/LOW
4. (Nose Gun) Rounds counter - SET
5. (SUU-16/23) Gun clear switch - NONCLEAR or AUTO-CLEAR
6. Delivery mode selector knob - OFF or DIRECT
7. Weapon selector knob - NOT IN TV or ARM (unless CAGE is depressed)
8. Station select - LOADED STATION(S)
   a. Green light(s) - ON
9. Guns/Missiles select switch - GUNS
   a. Heads up GUN light - ON
10. Master arm switch - ARM
    a. Heads up GUN light - GUN PODS, OFF (NOSE GUN, ON)
    b. Heads up ARM light - ON
    c. Station ARM light(s) - ON
11. Trigger switch - ACTUATE
    a. Zero rounds remaining, station ARM light - OFF

RANGE DEPARTURE

1. Sight mode selector knob - STBY or CAGE
2. Delivery mode selector knob - OFF
3. Station select - OFF
4. Master arm switch - SAFE

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select - OFF
3. Delivery mode selector knob - OFF
4. Radar missile power switch - OFF
5. Selective jettison knob - OFF
6. All DCU-94/A station select switches (5) - AFT
7. Sight mode selector knob - STBY or CAGE

ARMING AREA (DE-ARMING)

1. Armament switches - OFF/SAFE/NORMAL
2. Aircrew - HANDS IN VIEW

PART 4 NORMAL AIRCREW PROCEDURES F-4C D E

TABLE OF CONTENTS

RADAR SCOPE CAMERA (F-4C/D/E)

AFTER ENGINE START

These procedures assume no film is installed in the camera. With external electrical power applied, or with the engines running, proceed as follows:

1. Radar power - STBY
2. Camera power switch - ON
   a. Green continuity light - ON
   b. Amber film-remaining light - ON
      Without a magazine installed, the film-remaining light illuminates.

Note

If the lights do not function, check that the console light knob is full clockwise; or check that the camera electrical connector is installed.

3. Film magazine - INSTALLED
   Open the camera door and install the magazine in the prescribed manner; execute the installation procedure gently.
   a. Insert magazine into clamps so that magazine is aligned with sprocket gear on top-left side of camera.

CAUTION

Ensure magazine is seated against magazine stops or damage to sprocket may occur. On some cameras, the sprocket gear is spring loaded so that the door will not close with film magazine improperly installed.

   b. Close camera door.
   c. Amber film remaining light - OFF
      When the door is closed, the amber light goes off.
4. Witness mark switch - OFF
5. Acquisition rate selector - SET AS REQUIRED
6. Radar intensity control - FULL CLOCKWISE
7. Outer filter lever - ADJUST
   Adjust the outer filter lever to obtain the desired video level.

   The camera is now ready to take pictures. When the amber light illuminates, the exposed magazine should be removed and another inserted in the camera as stated in steps (1) thru (3) above. Camera operation can be stopped at any time by placing the camera power switch OFF.
8. Film title - INSERT
9. After 15 seconds, camera power switch - OFF
10. Film title - REMOVE

COCKPIT WEAPONS CHECK

BEFORE EXTERIOR INSPECTION

Before Electrical Power

IN ACCORDANCE WITH **AFR 60-9** , THE AIRCREW IS REQUIRED TO USE THIS CHECKLIST WHEN OPERATING THIS AIRCRAFT WITH NON–NUCLEAR WEAPONS. HOWEVER, THE EXTERIOR INSPECTIONS IN THIS CHECKLIST CONTAIN MISSION ESSENTIAL ITEMS WHICH THE AIRCREW IS NOT REQUIRED TO PERFORM SINCE THE CORRECT LOADING OF SUSPENSION EQUIPMENT AND WEAPONS IS THE RESPONSIBILITY OF CERTIFIED LOAD CREWS. THE EXTERIOR CHECKS PRECEDED BY A STAR (★) ARE CONSIDERED **SAFETY OF FLIGHT ITEMS** WHICH SHOULD BE CHECKED BY AN AIRCREW MEMBER IF TIME PERMITS. THE MISSION ESSENTIAL ITEMS MAY BE PERFORMED IF DESIRED.

CAUTION

DO NOT PLACE THE GENERATOR CONTROL SWITCHES TO **EXT ON** UNTIL EXTERNAL POWER HAS BEEN CONNECTED AND HAS REACHED RATED VOLTAGE AND FREQUENCY (400 CYCLES, 115/200 VOLTS AC).

F–4C/D/E BEFORE T.O. 1F–4E–556

1. AF FORM 781 – **CHECK**
2. WING STATION JETTISON SWITCH – **NORMAL**

CAUTION

THE EXTERNAL WING TANKS CAN BE JETTISONED BY THE EXTERNAL WING TANK JETTISON SWITCH ANY TIME ELECTRICAL POWER IS ON THE AIRCRAFT.

3. INTERNAL WING DUMP SWITCH – **NORMAL**

CAUTION

WITH ELECTRICAL POWER APPLIED TO THE AIRCRAFT WING FUEL WILL BE DUMPED ANY TIME THE INTERNAL WING DUMP SWITCH IS IN THE **DUMP** POSITION.

4. GEAR HANDLE – **DOWN**
5. MISSILE JETTISON SELECTOR KNOB – **OFF**
6. MISSILE ARM SWITCH – **SAFE**
7. MASTER ARM SWITCH – **SAFE**
8. GENERATOR SWITCHES – **OFF**

F–4E AFTER T.O. 1F–4E–556

1. AF FORM 781 – **CHECK**
2. INTERNAL WING DUMP SWITCH – **NORMAL**

CAUTION

WITH ELECTRICAL POWER APPLIED TO THE AIRCRAFT WING FUEL WILL DUMP ANY TIME THE INTERNAL WING DUMP SWITCH IS IN THE **DUMP** POSITION.

3. GEAR HANDLE – **DOWN**
4. MASTER ARM SWITCH – **SAFE**
5. DELIVERY MODE KNOB – **OFF**
6. JETTISON SELECTOR KNOB – **OFF**
7. GENERATOR SWITCHES – **OFF**

AFTER EXTERIOR INSPECTION

Armament Area (Arming)

1. ARMAMENT SWITCHES – **OFF/SAFE**
2. ARMAMENT SAFETY OVERRIDE BUTTON – **PUSH IN**

WARNING

WHEN THE ARMAMENT SAFETY OVERRIDE BUTTON IS ENERGIZED, THE JETTISON CIRCUIT IS PLACED IN AN INFLIGHT CONFIGURATION, THE AC HAS A JETTISON CAPABILITY DURING TAKEOFF WHILE WEIGHT IS ON THE GEAR.

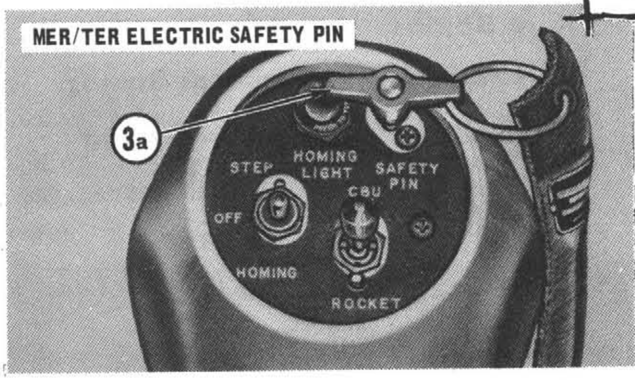
3. AIRCREW – **HANDS IN VIEW**
   THE AIRCREW WILL PLACE BOTH HANDS IN VIEW AS A SIGNAL TO THE LOAD CREW TO APPROACH THE AIRCRAFT, REMOVE ALL SAFETY PINS AND INSTALL ALL ACCESS COVERS, AND PERFORM ANY FINAL AIRCRAFT/WEAPON PREPARATIONS.

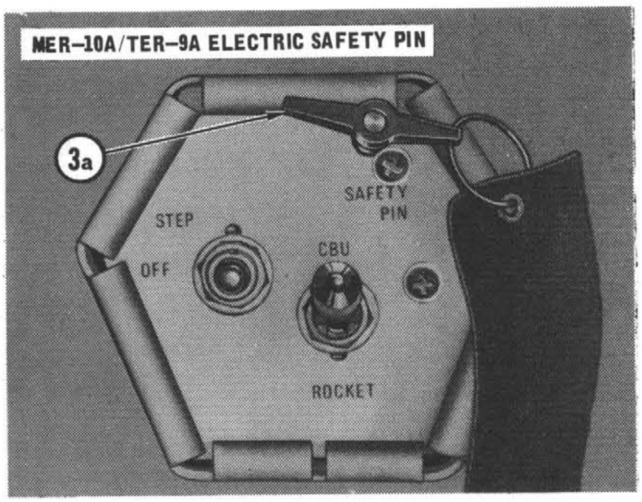
4C–34–1–1–(138)

Figure 2-20A

EXTERIOR INSPECTION

BOMBS





SUSPENSION EQUIPMENT

1. ARMAMENT PYLON – **CHECK**
   a. PYLONSAFETY PIN – **INSTALLED**
   ★ b. EJECTOR CARTRIDGES – **INSTALLED**
   c. INFLIGHT SAFETY LOCKOUT PIN – **INSTALLED**
   d. LOCK INDICATOR – **UNLOCKED**
   e. SWAYBRACES– **TIGHTENED**
2. CENTERLINE RACK – **CHECK**
   a. SAFETY PIN – **INSTALLED (REMOVED PRIOR TO ENGINE START)**
   ★ b. EJECTOR CARTRIDGES – **INSTALLED**
   c. SWAY BRACES ON CENTERLINE ADAPTER – **TIGHTENED**
3. MER/TER – **CHECK**
   a. ELECTRICAL SAFETY PIN – **INSTALLED**
   b. EJECTOR RACK SAFETY PIN – **INSTALLED**
   ★ c. EJECTOR RACK CARTRIDGES – **INSTALLED**
   CARTRIDGES ARE REMOVED IF BREACH CAP CABLE CAN BE PUSHED INTO BREACH
   d. SHORTING PLUG – **INSTALLED**
   e. EJECTOR FOOT – **SEATED AGAINST WEAPON**
   f. SWAYBRACES– **TIGHTENED**

★ SAFETY OF FLIGHT ITEM

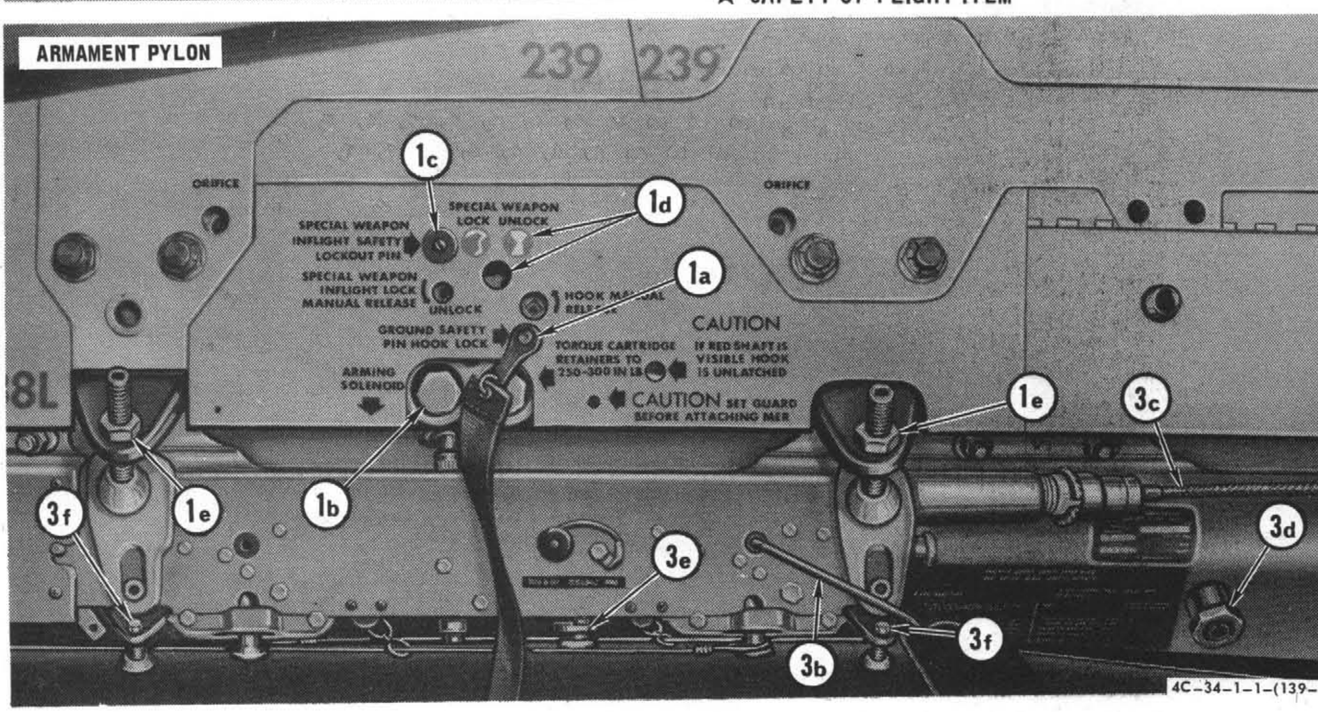


Figure 2-21 (Sheet 1 of 10)

EXTERIOR INSPECTION (CONTINUED)

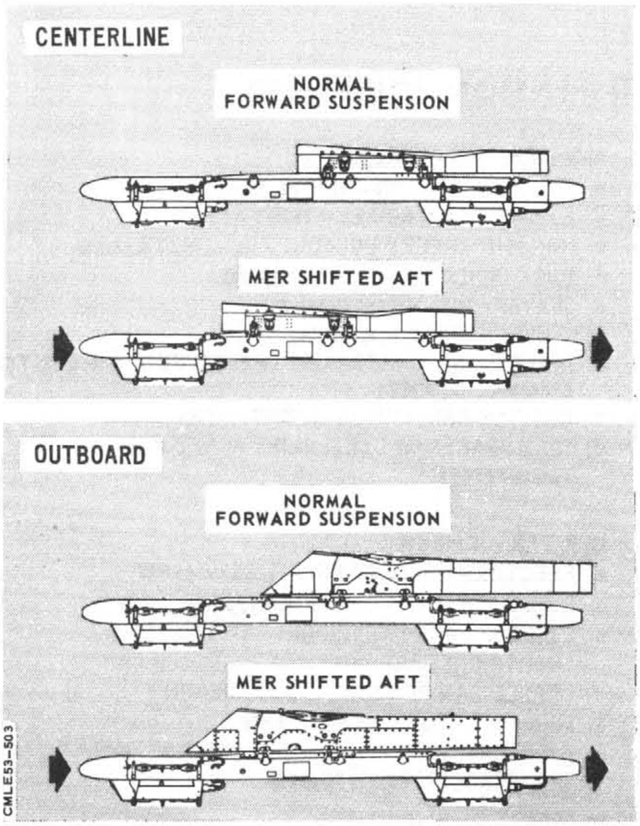
BOMBS

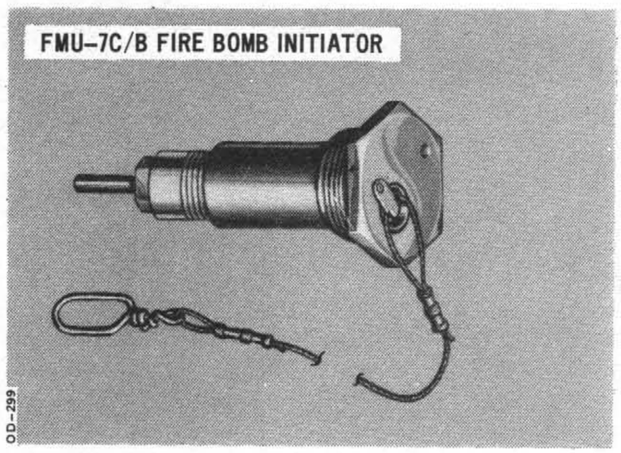
BLU-1/B, B/B, C/B, -27/B, A/B Fire Bombs

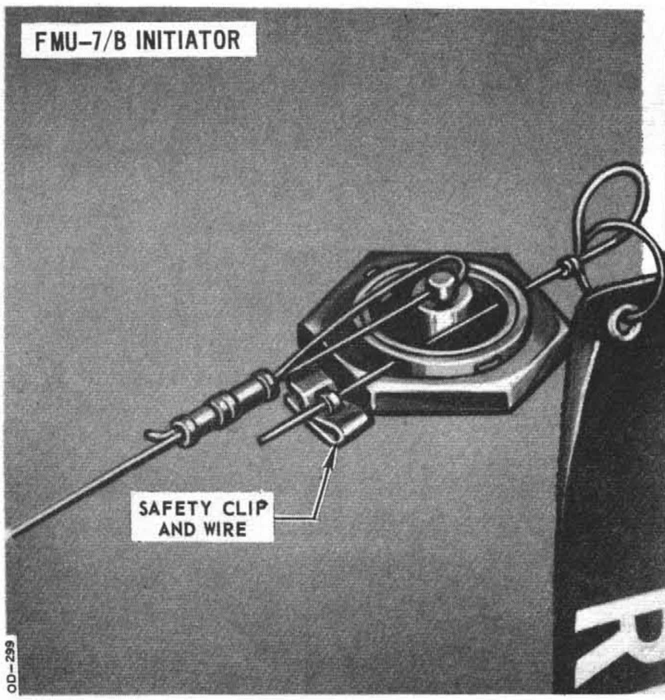
BLU-52/B, A/B Chemical Bombs

★ 1. (UNFINNED) MER POSITION – **FORWARD**
★ 2. (FINNED) MER POSITION – **AFT**
3. INITIATOR SAFETY/SHEAR WIRE – **INSTALLED**
4. ARMING LANYARD – **CONNECTED**
5. NOSE AND TAIL CAPS – **SECURE**
★ 6. FIN CONFIGURATION – **(X)**
7. FIRE BOMB – **SECURE NO LEAKS**

★ SAFETY OF FLIGHT ITEM







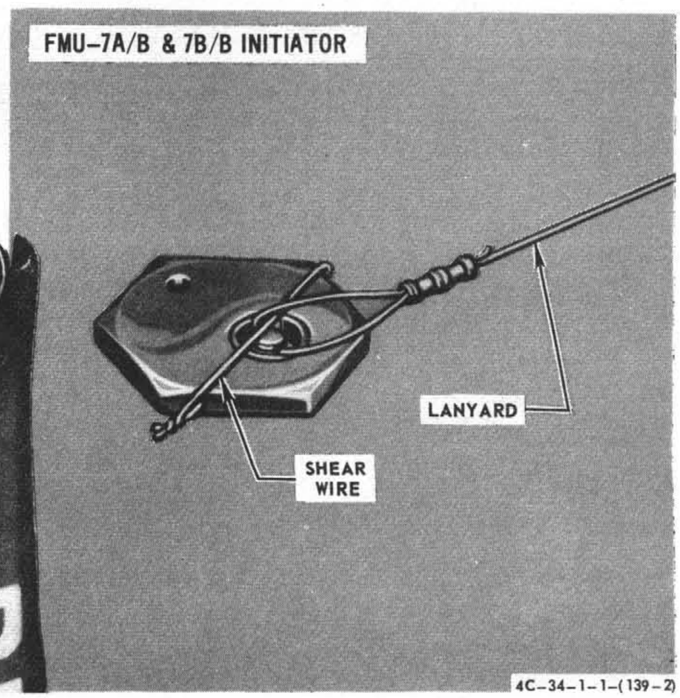
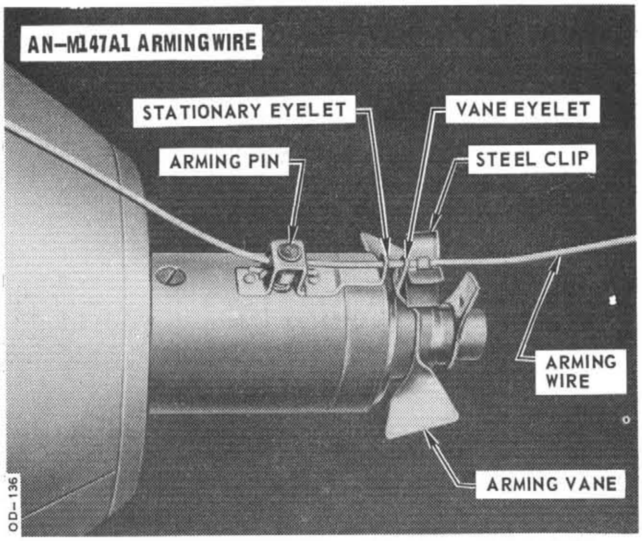
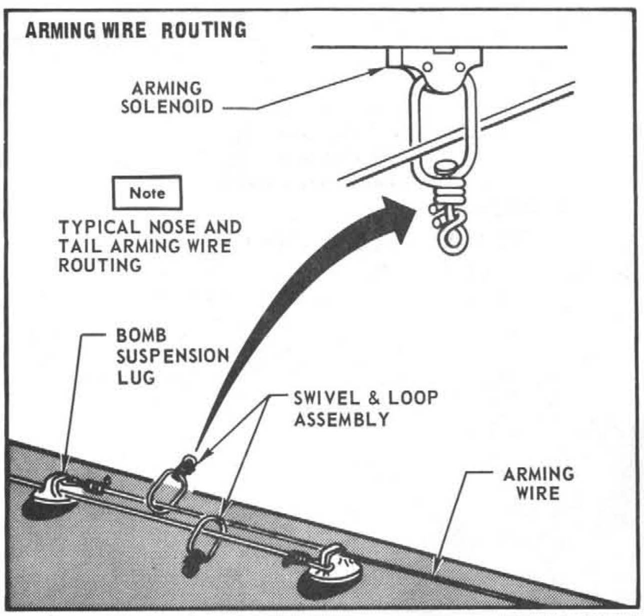


Figure 2-21 (Sheet 2 of 10)

EXTERIOR INSPECTION (CONTINUED)

BOMBS





M117 GP, MC-1 Gas, M129E1, E2 LEAFLET, MK82, 83, 84 & M118GP Bombs

★1. MER POSITION – **CHECK**
   a. M117, MC–1, M129E1, MK 82 – **FORWARD**
   b. MK 83 OUTBOARD – **AFT**
   c. MK 83 CENTERLINE – **FORWARD**

★2. FIN CONFIGURATION – **CHECK**
   a. M117, MC–1, M129E1, E2 ON AIRCRAFT STATIONS 1 AND 9, OUTBOARD MER REAR SHOULDER POSITIONS – **PLUS**, ALL OTHER STATIONS – **(X)**
   b. MK 83 – **PLUS**
   c. MK 82, MK 84, M118 – **(X)**

3. ARMING WIRES AND STEEL CLIPS – **INSTALLED**

★4. FUZES – **CHECK RECORDED FUZE SETTINGS**

★SAFETY OF FLIGHT ITEM

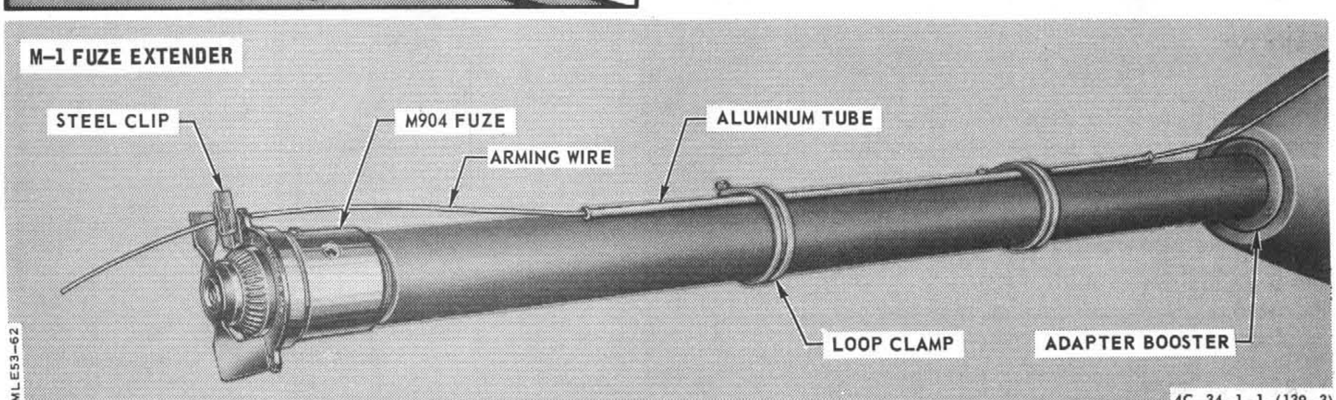
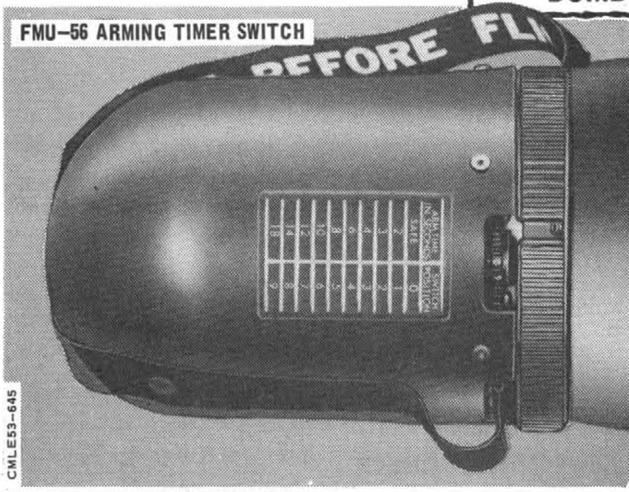


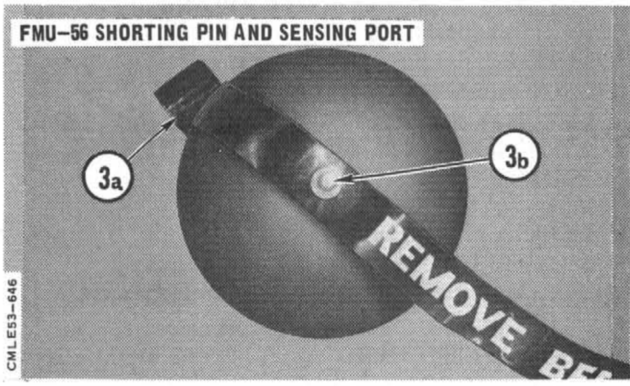
Figure 2-21 (Sheet 3 of 10)

EXTERIOR INSPECTION

(CONTINUED)

BOMBS





SUU-30 DISPENSERS AND BOMBS

SUU-	CBU-	BLU-
30/B	24/B 29/B 49/B	26/B 36/B 59/B
30A/B	24A/B 29A/B 49A/B	26/B 36/B 59/B
30B/B	24B/B 29B/B 49B/B 52A/B 70/B	26/B 36/B 59/B 61A/B 85/B
30C/B	24C/B 29C/B 49C/B	26/B 36/B 59/B
30H/B	52B/B 58/B 71/B	61A/B 63/B 86/B

★1. MER POSITION– **FORWARD**
★2. FIN CONFIGURATION– **(X)**
★3. FMU-26A/B, B/B,-56/B, A/B, B/B FUZE – **CHECK RECORDED SETTINGS**
   a. (-56/B) SHORTING PIN– **INSTALLED**
   b. (-56/B) VELOCITY SENSOR SW PORTS **COVERED WITH TAPE**

WARNING

DO NOT PULL ON THE BATTERY FIRING DEVICE LANYARD. FORCES GREATER THAN 15 LBS MAY COCK THE INIATOR & RELEASE THE FIRING PIN.

   c. LANYARD, SWIVEL & LINKS– **SECURE**

★ SAFETY OF FLIGHT ITEM

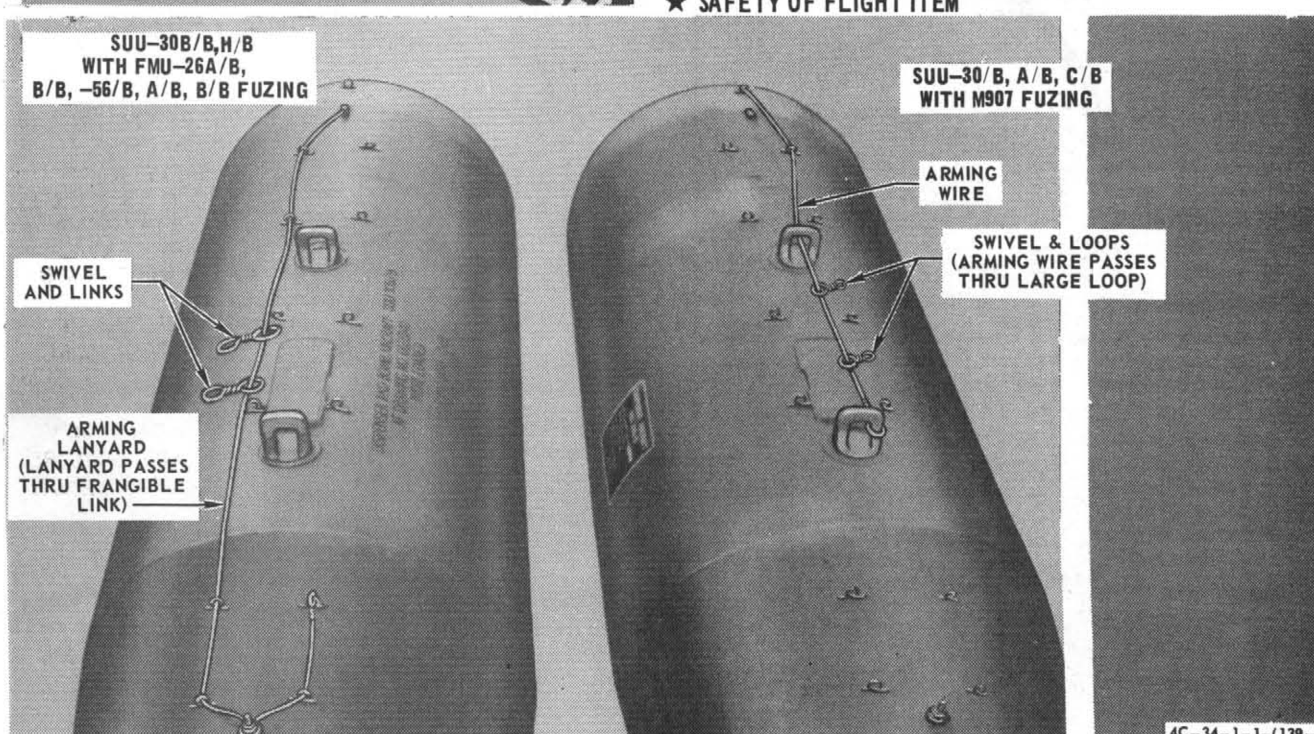
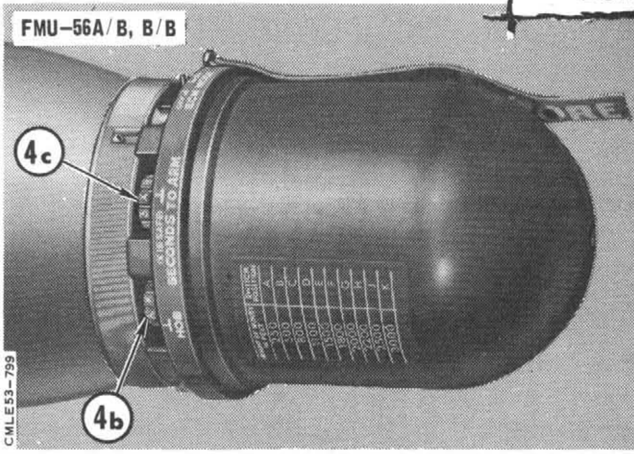
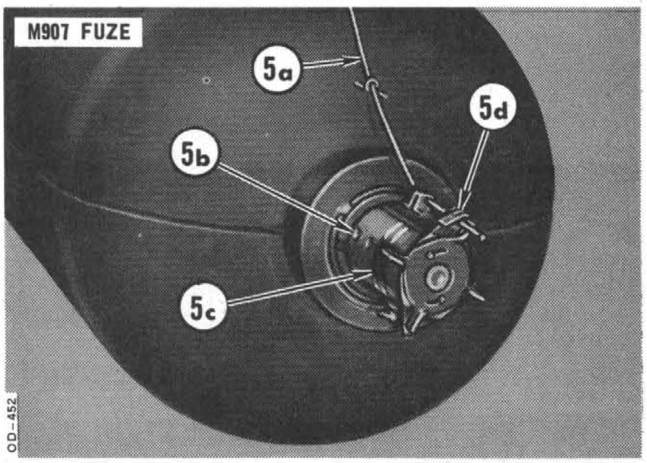


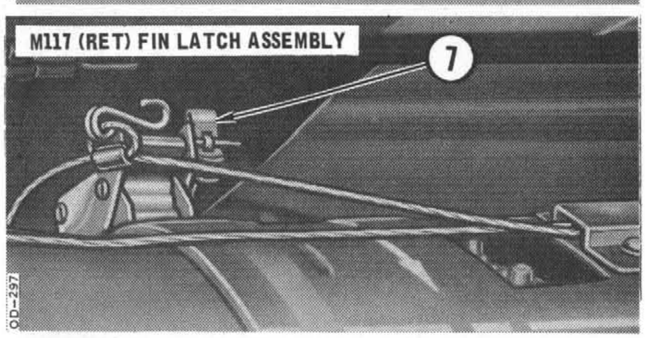
Figure 2-21 (Sheet 4 of 10)

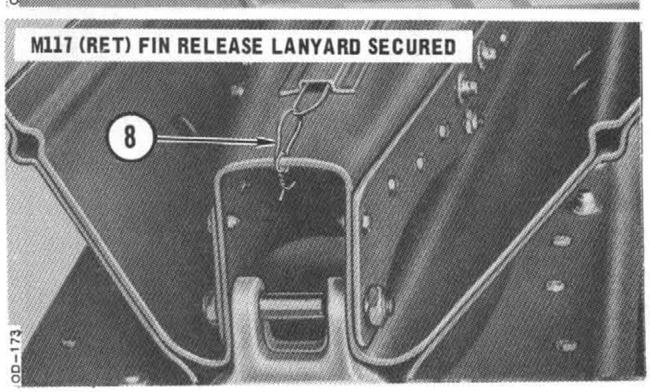
EXTERIOR INSPECTION (CONTINUED)

BOMBS









4. FMU-56A/B, B/B FUZE – **CHECK RECORDED SETTINGS**
   a. PITOT TUBE – **RETRACTED**

   WARNING

   IF THE PITOT TUBE IS EXTENDED, THE FUZE MUST BE TREATED AS ARMED AND APPROPRIATE AUTHORITIES SHOULD BE NOTIFIED IMMEDIATELY.

   b. HEIGHT OF BURST (HOB) SWITCH – **SET AS BRIEFED**
   c. ARMING TIMER SWITCH – **SET AS BRIEFED**
   d. ECM SWITCH – **SET AS BRIEFED**
   e. LANYARD, SWIVEL & LINKS – **SECURE**
5. M907 FUZE
   a. ARMING WIRE, SWIVEL & LOOPS – **SECURE**
   b. FOIL DISC – **NOT PUNCTURED**
   c. ARMING TIME – **SET AS BRIEFED**
   d. STEEL CLIP – **INSTALLED**

M117R & MK82 SNAKEYE

★ 1. MER POSITION – **FORWARD**
★ 2. LOAD CONFIGURATION – **SINGLE OR RIPPLE RELEASE**
★ 3. FIN CONFIGURATION – **(X)**
4. (M117R) MAU-91A/B OR MAU-91B/B FIN USED
★ 5. (H/L) ARMING WIRE CONFIGURATION – **CHECK**
   ★ a. NOSE FUZE ARMING WIRE TIED TO AFT LUG WITH SWIVEL AND LOOP IN NOSE ARMING SOLENOID
   ★ b. TAIL FUZE ARMING LANYARD AND FIN RELEASE LANYARD/WIRE ATTACHED TO A SWIVEL AND LINK: SWIVEL AND LINK IS IN TAIL ARMING SOLENOID.
★ 6. FUZES – **CHECK RECORDED FUZE SETTING**
   ★ a. (H/L) M904E2/E3 NOSE FUZE – **6.0 SEC MINIMUM**
   ★ b. (H/L) FMU-54 TAIL FUZE – **2.5 SEC MINIMUM**
   ★ c. (M904E2/E3) STEEL CLIP – **INSTALLED**
★ 7. (M117R) FAHNESTOCK CLIP INSTALLED ON REAR OF FIN LATCH ASSEMBLY RELEASE PIN.
8. (M117R) FIN RELEASE LANYARD LOOP AT AFT END OF CHANNEL SECURED BY STAINLESS STEEL SAFETY WIRE.

Note

WHEN FMU-54 IS NOT INSTALLED AND WHEN HIGH DRAG ONLY CONFIGURATION IS DESIRED, THE NOSE ARMING WIRE IS SECURED TO THE AFT END OF THE TAIL FIN; SWIVEL AND LOOP TO NOSE SOLENOID IS NOT USED.

9. (MK 82) FAHNESTOCK CLIP INSTALLED (AGAINST GUIDE TUBE) ON FIN REL WIRE WITH 4 INCHES OF WIRE EXTENDING AFT OF FIN. (See sheet 6)

★ SAFETY OF FLIGHT ITEM
(H/L) = HIGH/LOW DRAG INFLIGHT OPTION

4C-34-1-1-(139-5)

Figure 2-21 (Sheet 5 of 10)

EXTERIOR INSPECTION (CONTINUED)

BOMBS

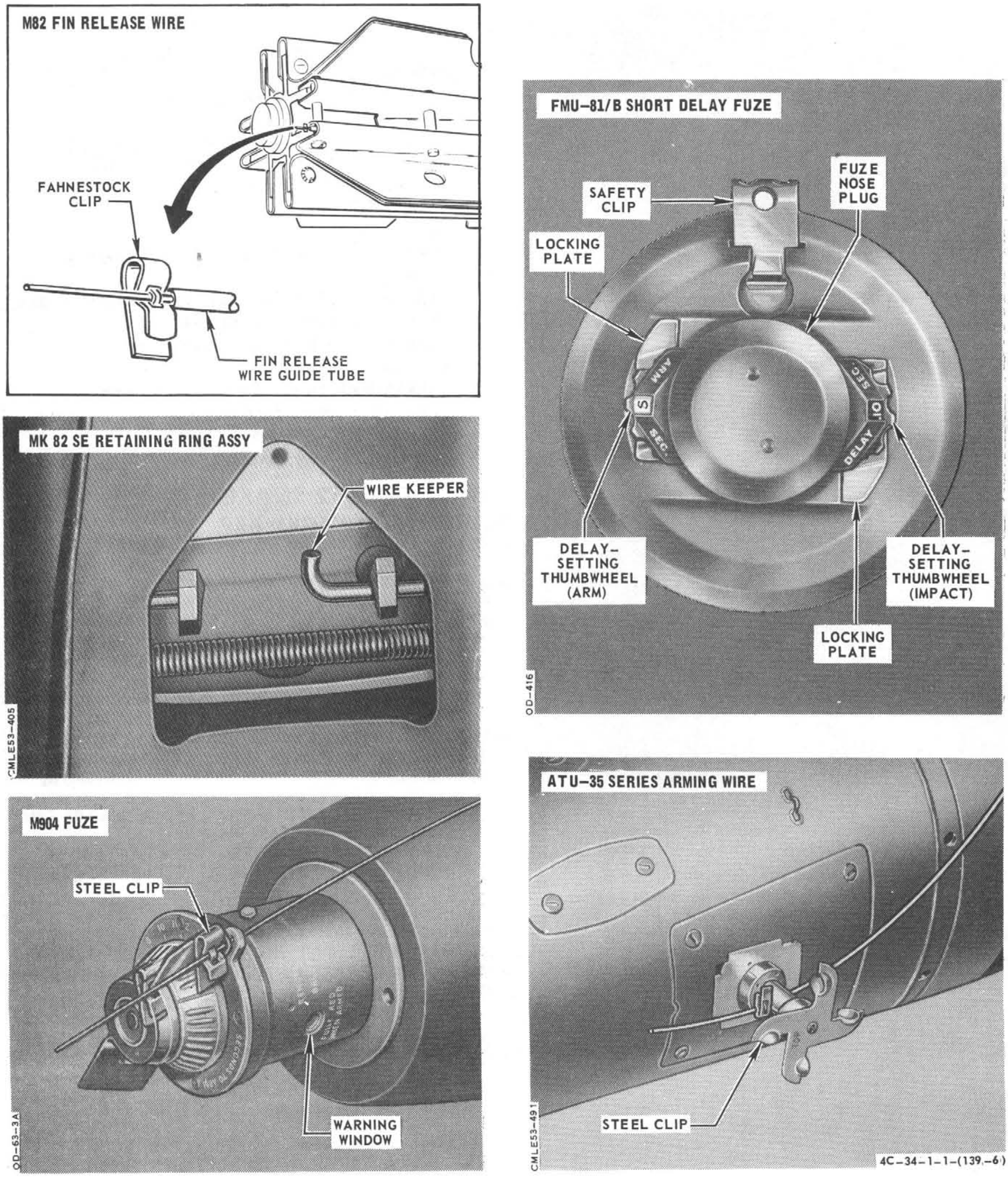


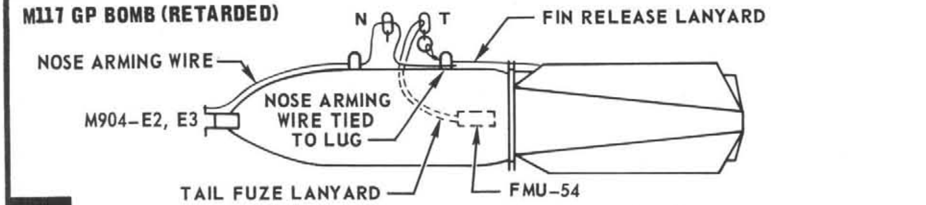
Figure 2-21 (Sheet 6 of 10)

EXTERIOR INSPECTION (CONTINUED)

BOMBS

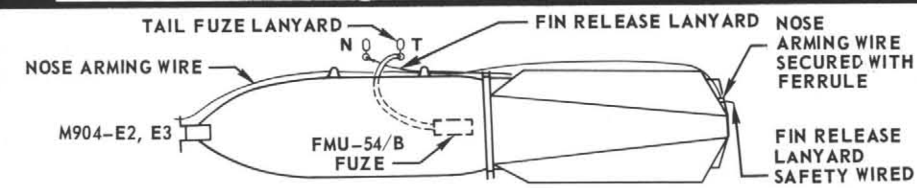
N = NOSE SOLENOID
T = TAIL SOLENOID
+ POSITIVE ARMING, FINS MUST OPEN TO ARM FUZE.

M117 GP BOMB (RETARDED)



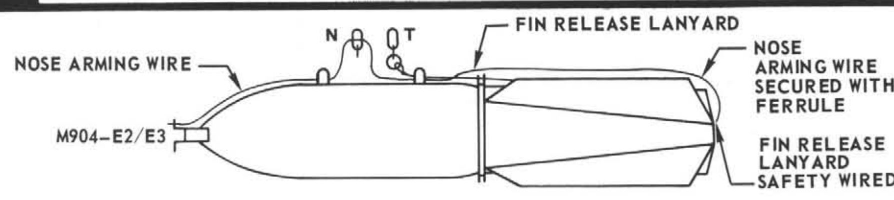
1 (HIGH OR LOW DRAG COCKPIT SELECTABLE)

ARM SWITCH	DRAG	FUZE ARM
NOSE	LOW	NOSE ONLY
TAIL	HIGH	TAIL ONLY
N & T	HIGH	NOSE & TAIL



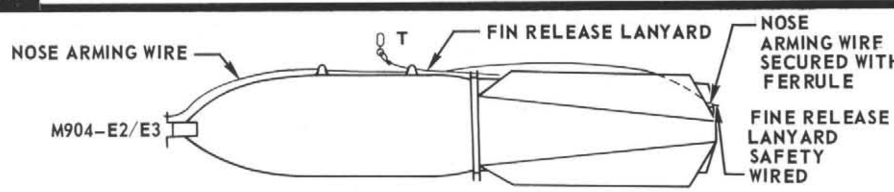
2 (HIGH DRAG FUZE SELECTABLE)

ARM SWITCH	DRAG	FUZE ARM
NOSE	HIGH	+ NOSE ONLY
TAIL	LOW	DUD
N & T	HIGH	+ NOSE & TAIL



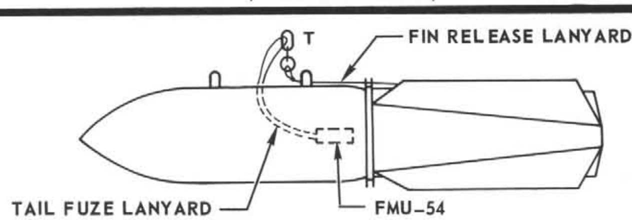
3 (HIGH OR LOW DRAG COCKPIT SELECTABLE)

ARM SWITCH	DRAG	FUZE ARM
NOSE	LOW	NOSE
TAIL	HIGH	+ NOSE
N & T	HIGH	NOSE



4 (HIGH DRAG ONLY)

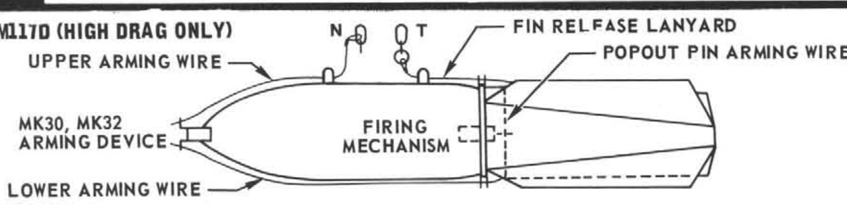
ARM SWITCH	DRAG	FUZE ARM
NOSE	LOW	DUD
TAIL	HIGH	+ NOSE
N & T	HIGH	+ NOSE



5 (HIGH DRAG ONLY)

ARM SWITCH	DRAG	FUZE ARM
NOSE	LOW	DUD
TAIL	HIGH	TAIL
N & T	HIGH	TAIL

M117D (HIGH DRAG ONLY)



6

ARM SWITCH	DRAG	FUZE ARM
NOSE	LOW	DUD
TAIL	HIGH	DUD
N & T	HIGH	+ NOSE & TAIL

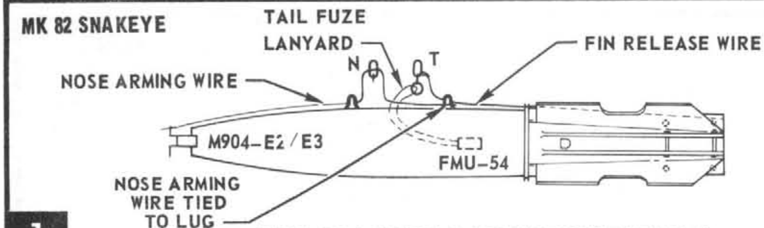
4C-34-1-1-(139-7)

Figure 2-21 (Sheet 7 of 10)

EXTERIOR INSPECTION (CONTINUED)

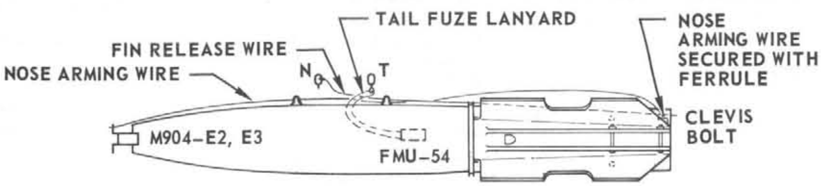
BOMBS

N = NOSE SOLENOID
T = TAIL SOLENOID
+ POSITIVE ARMING, FINS MUST OPEN TO ARM FUZE.



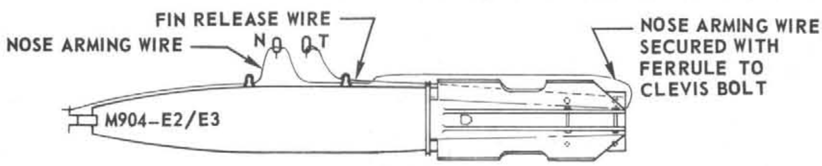
1 (HIGH OR LOW DRAG COCKPIT SELECTABLE)

ARM SWITCH	DRAG	FUZE ARM
NOSE	LOW	NOSE ONLY
TAIL	HIGH	TAIL ONLY
N & T	HIGH	NOSE & TAIL



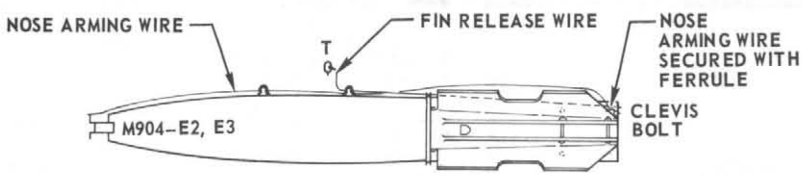
2 HIGH DRAG FUZE SELECTABLE

ARM SWITCH	DRAG	FUZE ARM
NOSE	HIGH	+ NOSE ONLY
TAIL	LOW	DUD
N & T	HIGH	+ NOSE & TAIL



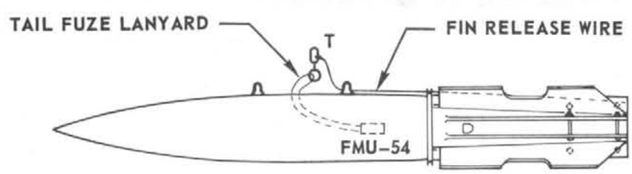
3 (HIGH OR LOW DRAG COCKPIT SELECTABLE)

ARM SWITCH	DRAG	FUZE ARM
NOSE	LOW	NOSE
TAIL	HIGH	+ NOSE
N & T	HIGH	NOSE



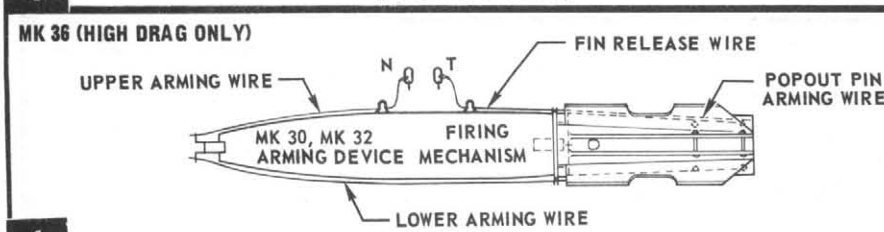
4 (HIGH DRAG ONLY)

ARM SWITCH	DRAG	FUZE ARM
NOSE	LOW	DUD
TAIL	HIGH	+ NOSE
N & T	HIGH	+ NOSE



5 (HIGH DRAG ONLY)

ARM SWITCH	DRAG	FUZE ARM
NOSE	LOW	DUD
TAIL	HIGH	TAIL
N & T	HIGH	TAIL



6

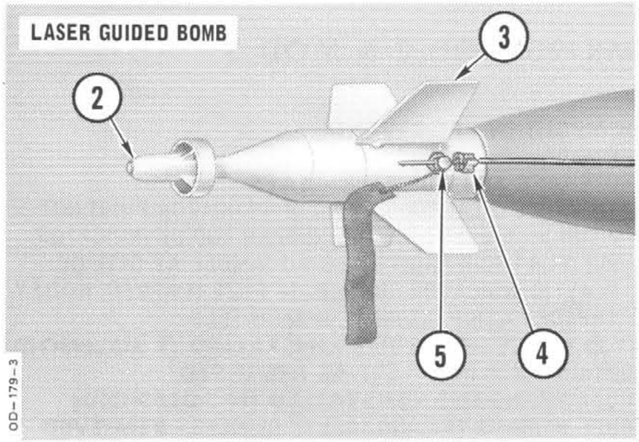
ARM SWITCH	DRAG	FUZE ARM
NOSE	LOW	DUD
TAIL	HIGH	DUD
N & T	HIGH	+ NOSE & TAIL

4C-34-1-1-(139-8)

Figure 2-21 (Sheet 8 of 10)

EXTERIOR INSPECTION (CONTINUED)

BOMBS



KMU-351/B (MK-84) and KMU-370A/B (M118) KMU-388/B (MK 82) Laser Guided Bombs

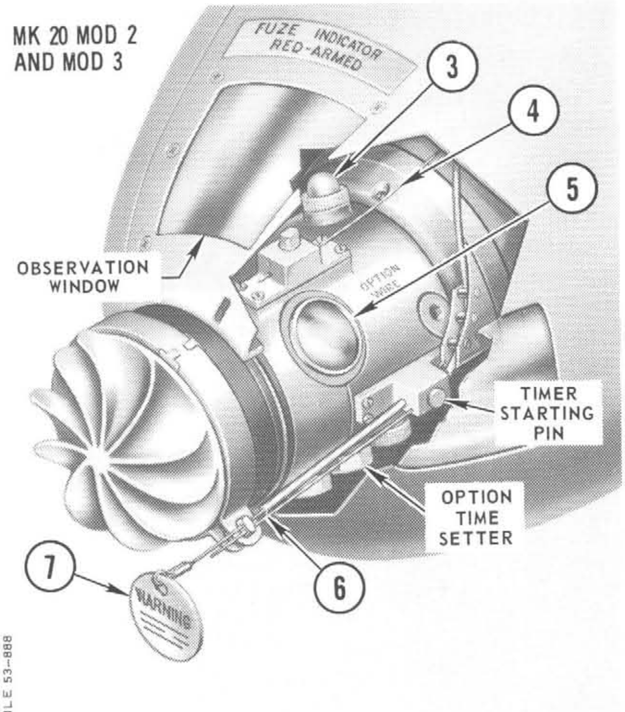
1. IR DOME WINDOW – **NO DAMAGE**
   CHECK IR DOME WINDOW FREE OF CRACKS/SCRATCHES OR DAMAGE.
2. DETECTOR HEAD – **FREE TO SWIVEL**
3. CANARDS – **SECURE**
4. THERMAL BATTERY ARMING WIRE AND STEEL CLIP – **INSTALLED**
5. THERMAL BATTERY SAFETY PIN – **REMOVED**
6. FMU-26 FUZE LANYARD – **INSTALLED**
7. ATU-35 SERIES ARM. WIRE & STEEL CLIP – **INSTALLED**
8. BOMB AFT WING ASSEMBLY – **SECURE**

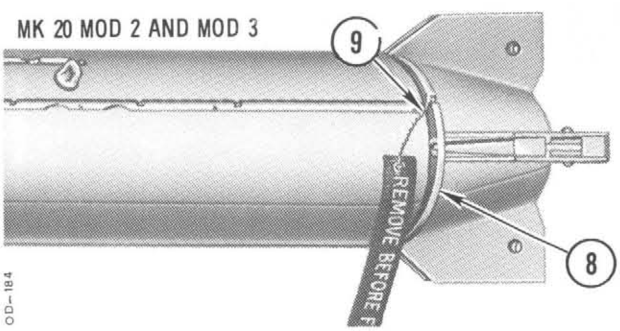
4C-34-1-1-(139-9)

Figure 2-21 (Sheet 9 of 10)

EXTERIOR INSPECTION (CONTINUED)

BOMBS





MK 20 MOD 2 & MOD 3

1. MER POSITION – **FORWARD**
2. FUZE COVER – **REMOVED**
3. FUZE SAFE/ARM INDICATOR – **SAFE**
   THE FUZE IS SAFE WHEN END OF INDICATOR PIN IS NOT VISIBLE. THE FUZE IS ARMED WHEN END OF INDICATOR PIN (FLAT SIDE PAINTED RED) IS VISIBLE AT BASE OF PLASTIC INDICATOR BUBBLE. IF FUZE IS ARMED, NOTIFY APPROPRIATE PERSONNEL IMMEDIATELY.
4. (MOD 3) FUZE OPTION WIRE – **INSTALLED (T SOLENOID)**
5. OPTION TIMER DIAL – **SET AS REQUIRED**
6. FUZE ARMING WIRE – **INSTALLED (N SOLENOID)**
7. FUZE WARNING TAG AND SAFETY DEVICES – **REMOVED**
8. FIN RELEASE BAND WIRE – **INSTALLED (GUN REMOVAL PIN)**
9. FIN RELEASE BAND SAFETY PIN – **REMOVED**

M36E2 INCENDIARY CLUSTER BOMB

★1. M36E2 IDENTIFICATION – **CHECK**
   CHECK STENCIL ON SIDE OF EACH WEAPON; THE M36 **(NOT M35)** MUST BE ABOARD (M36 AND M35 APPEAR IDENTICAL).
★2. MER POSITION – **FORWARD**
3. NOSE FAIRING – **REMOVED**
4. ARMING WIRES – **INSTALLED (N & T SOLENOIDS)**
★5. FINS –
   a. FIN CONFIGURATION – **(X)**
   b. FINS DO NOT TOUCH OR OVERLAP FINS OF ADJACENT WEAPON.
6. TAIL FUZES (2) – **CHECK**
   a. FUZE TIME SETTINGS – **MISSION REQUIREMENT**
   b. STEEL CLIP – **INSTALLED**

★ SAFETY OF FLIGHT ITEM

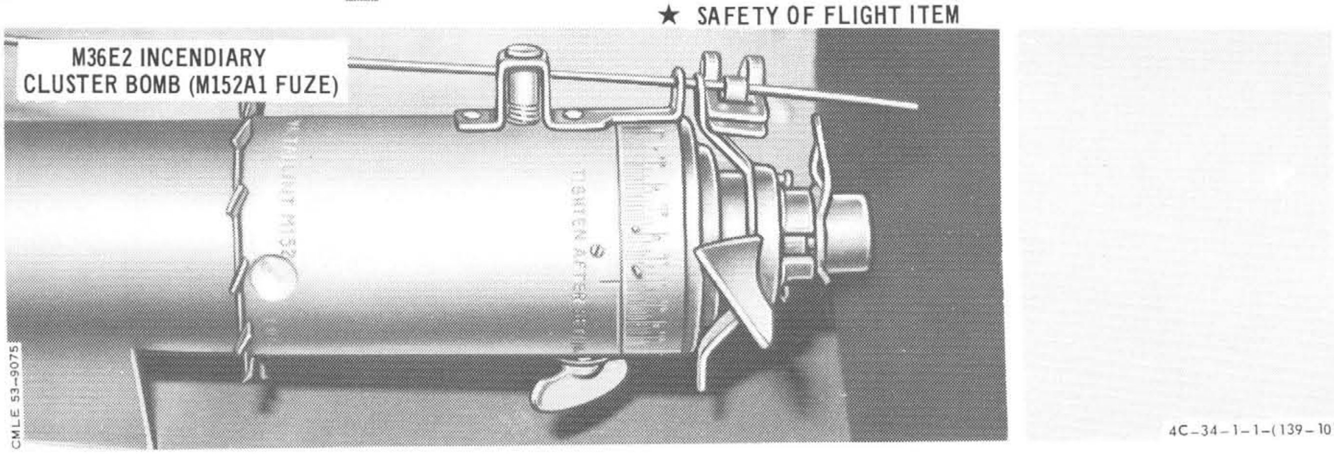
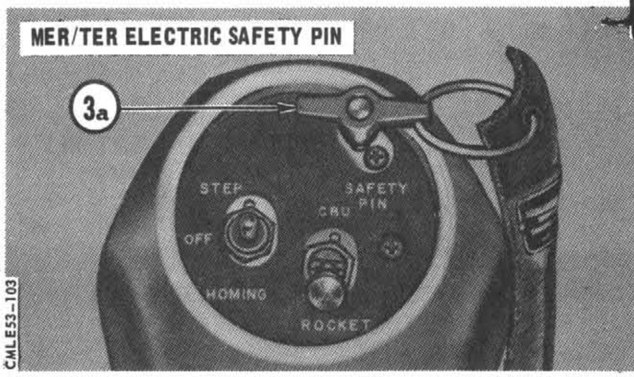
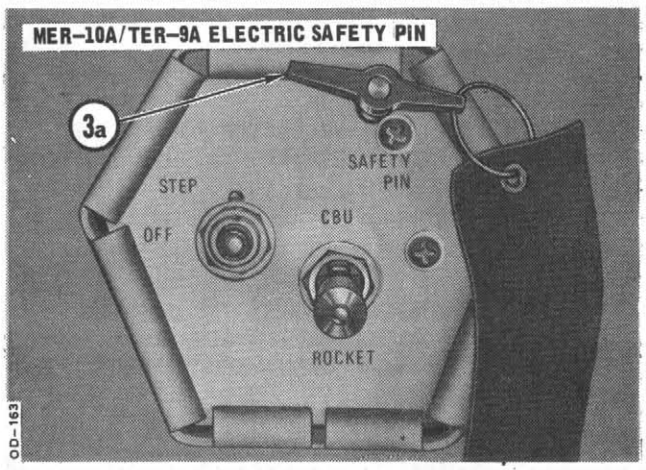


Figure 2-21 (Sheet 10 of 10)

EXTERIOR INSPECTION

ROCKETS

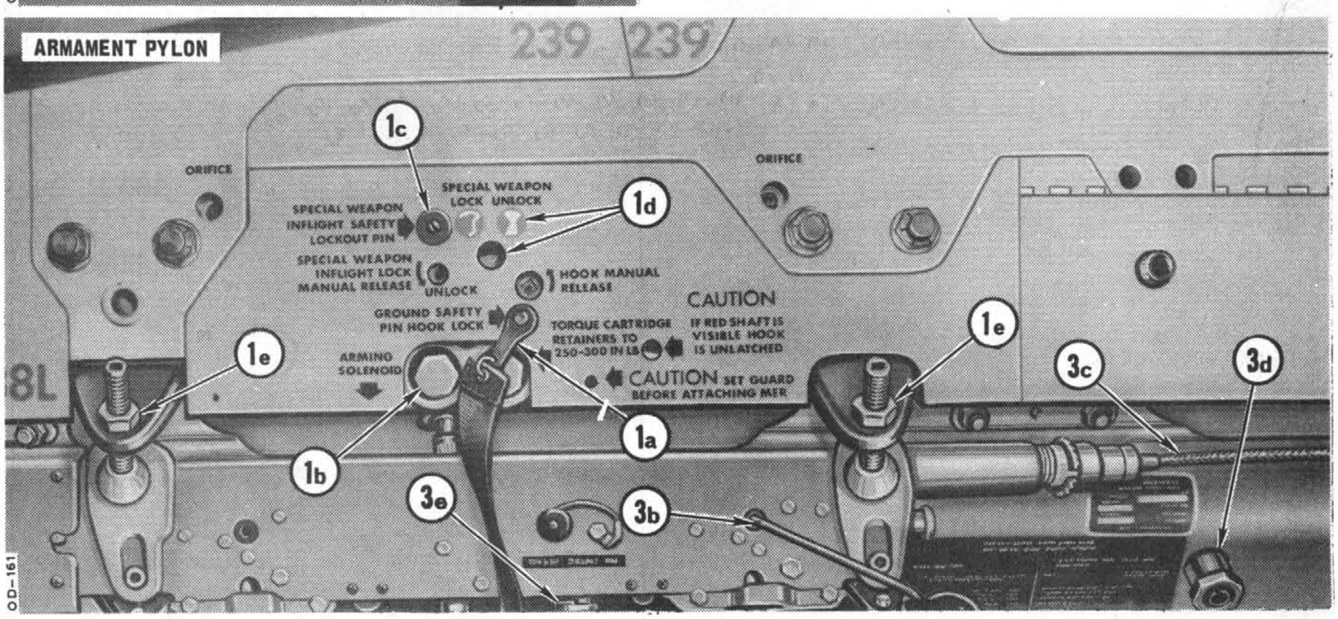




SUSPENSION EQUIPMENT

1. ARMAMENT PYLON – **CHECK**
   a. PYLON SAFETY PIN – **INSTALLED**
   ★ b. EJECTOR CARTRIDGES – **INSTALLED**
   c. INFLIGHT SAFETY LOCKOUT PIN – **INSTALLED**
   d. LOCK INDICATOR – **UNLOCKED**
   e. SWAYBRACES– **TIGHTENED**
2. CENTERLINE RACK – **CHECK**
   a. SAFETY PIN – **INSTALLED**
   (REMOVED PRIOR TO ENGINE START)
   ★ b. EJECTOR CARTRIDGES –**INSTALLED**
   c. SWAY BRACES ON CENTERLINE ADAPTER –**TIGHTENED**
3. MER/TER – **CHECK**
   a. ELECTRICAL SAFETY PIN – **INSTALLED**
   b. EJECTOR RACK SAFETY PIN – **INSTALLED**
   ★ c. EJECTOR RACK CARTRIDGES –**INSTALLED**
   CARTRIDGES ARE REMOVED IF BREACH CAP CABLE CAN BE PUSHED INTO BREACH.
   d. UNUSED EJECTOR STATIONS, SHORTING PLUG – **INSTALLED**
   e. EJECTOR FOOT – **SEATED AGAINST WEAPON**
   f. SWAYBRACES– **TIGHTENED**

★ SAFETY OF FLIGHT ITEM

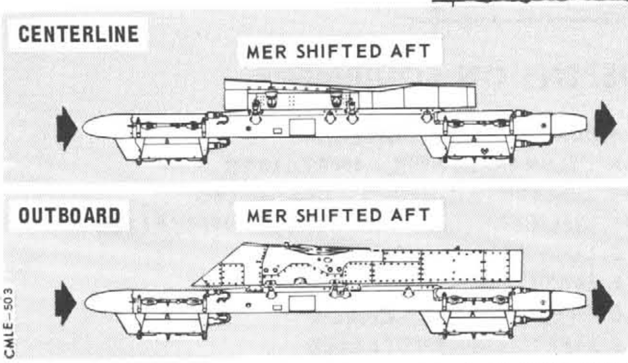


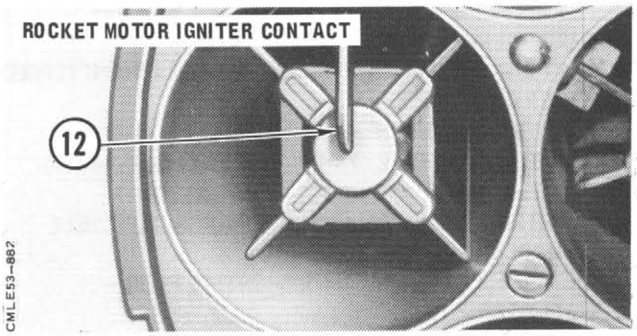
4C-34-1-1-(140-1)

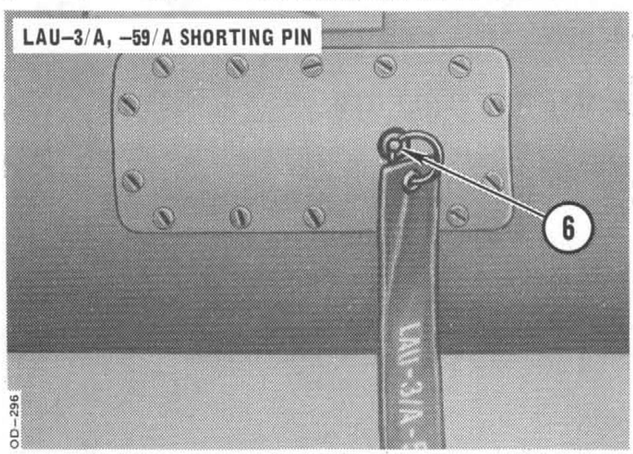
Figure 2-22 (Sheet 1 of 2)

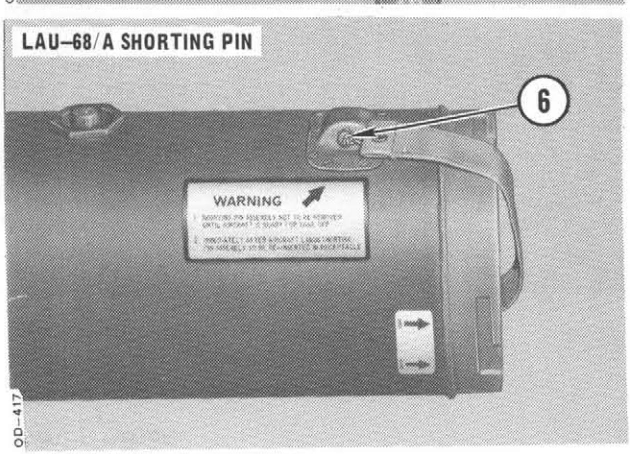
EXTERIOR INSPECTION (CONTINUED)

ROCKETS









★ 1. MER POSITION – **AFT**

★ 2. (OUTBOARD TER SHOULDER) WITH AIRCRAFT STATION 1/9 LOADED, EJECTOR RACK CARTRIDGE – **REMOVED**

3. MER/TER SWITCH – **ROCKETS**
4. (MER/TER CARRIAGE) ROCKET HARNESS (BLUE) – **CONNECTED**
5. (LAU-3/A SINGLE CARRIAGE ON MAU-12) SHORTING PIN AND ELECTRICAL CABLE – **INSTALLED**
6. LAU-3/A. LAU-59/A, -68A/A,) SHORTING PIN – **INSTALLED**
7. (LAU-32B/A, -59/A, -68A/A) LAU DIAL INDICATOR – **ARM**
8. (LAU-32B/A, -59/A, -68A/A) LAU SELECTOR SW – **SINGLE/RIPPLE**
9. (LAU-3/A, -32A/A) INTERVALOMETER – **INSTALLED**

★ 10. LAUNCHERS – **SECURE, PROPER STA., CONDITION**

★ 11. NOSE AND TAIL FAIRINGS – **LOCKED**
TWIST OR PUSH DOWN ON FAIRING. LOCK INDICATING ARROWS NEED NOT BE ALIGNED IF THE FAIRING IS LOCKED.

12. ROCKET MOTOR IGNITER CONTACT – **TOUCHING LAUNCHER GROUND FIRING CONTACT**
13. ROCKET QUANTITY AND WARHEAD – **MISSION REQUIREMENT**

★ SAFETY OF FLIGHT ITEM

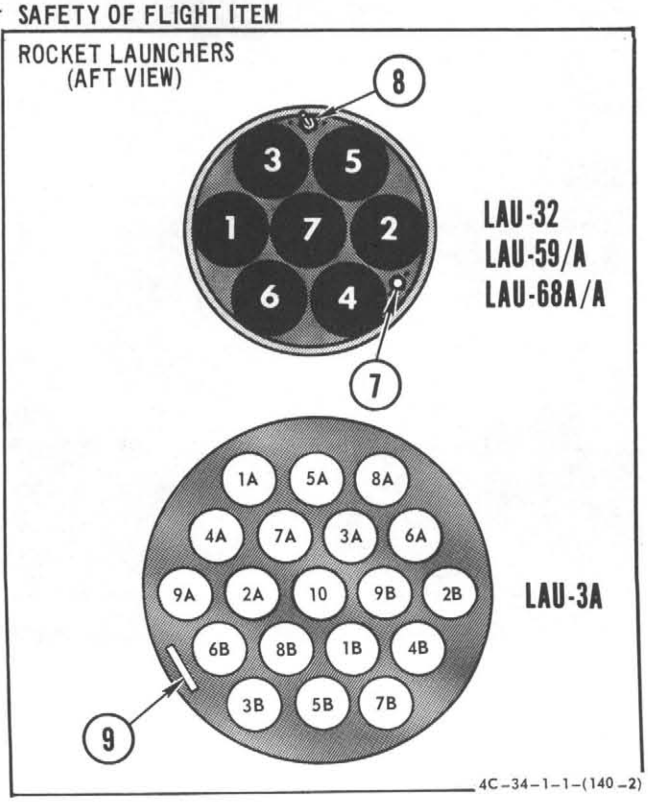
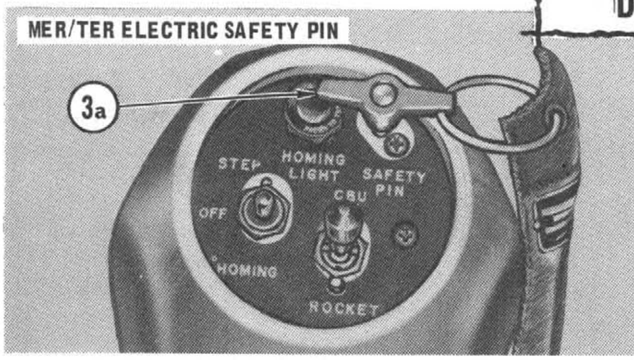


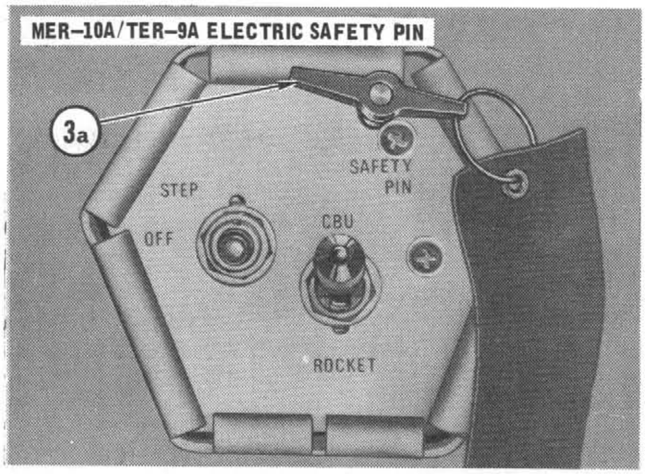
Figure 2-22 (Sheet 2 of 2)

"All data on pages 2-100N and 2-100P deleted."

EXTERIOR INSPECTION

DISPENSERS

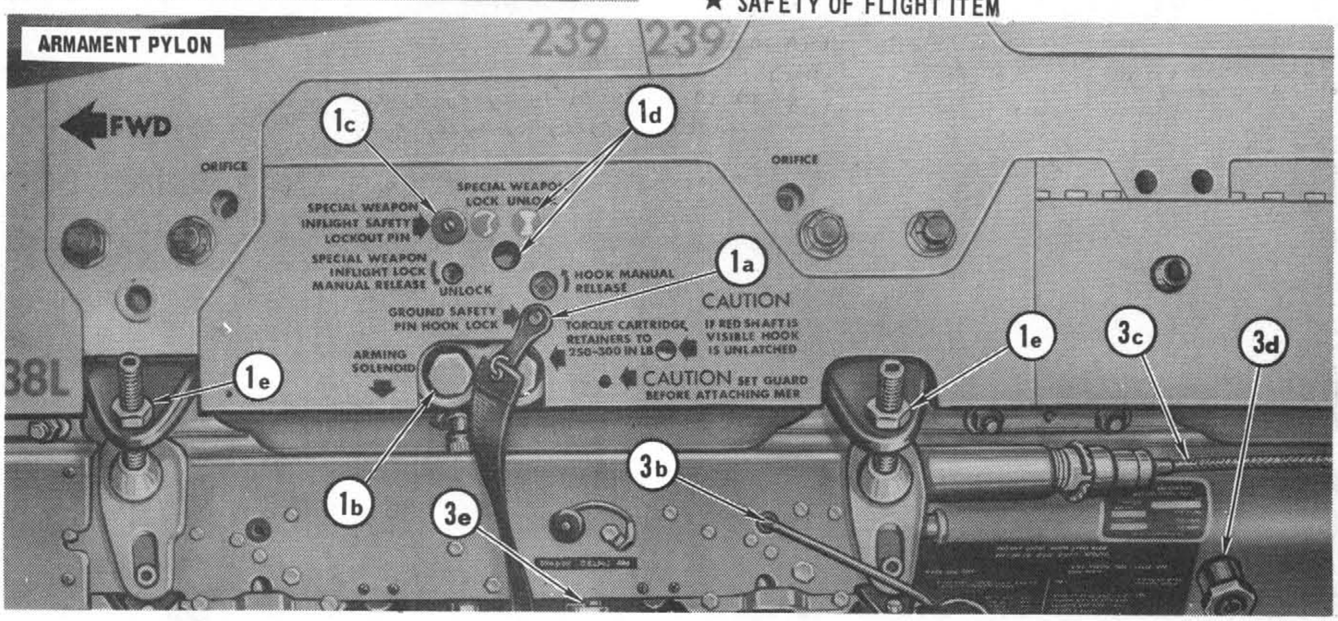




SUSPENSION EQUIPMENT

1. ARMAMENT PYLON – **CHECK**
   a. PYLON SAFETY PIN – **INSTALLED**
   ★ b. EJECTOR CARTRIDGES – **INSTALLED**
   c. INFLIGHT SAFETY LOCKOUT PIN – **INSTALLED**
   d. LOCK INDICATOR – **UNLOCKED**
   e. SWAYBRACES– **TIGHTENED**
2. CENTERLINE RACK – **CHECK**
   a. SAFETY PIN – **INSTALLED** **(REMOVE PRIOR TO ENGINE START)**
   ★ b. EJECTOR CARTRIDGES – **INSTALLED**
   c. SWAY BRACES ON CENTERLINE ADAPTER – **TIGHTENED**
3. MER/TER – **CHECK**
   a. ELECTRICAL SAFETY PIN – **INSTALLED**
   b. EJECTOR RACK SAFETY PIN – **INSTALLED**
   ★ c. EJECTOR RACK CARTRIDGES – **INSTALLED**
   CARTRIDGES ARE REMOVED IF BREACH CAP CABLE CAN BE PUSHED INTO BREACH.
   d. UNUSED EJECTOR STATIONS, SHORTING PLUG – **INSTALLED**
   e. EJECTOR FOOT – **SEATED AGAINST WEAPON**
   f. SWAYBRACES– **TIGHTENED**

★ SAFETY OF FLIGHT ITEM

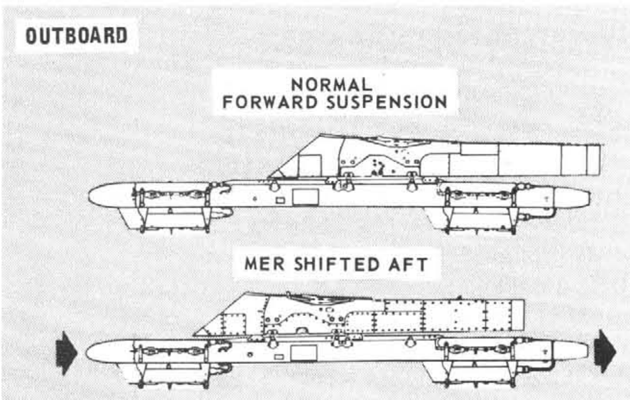


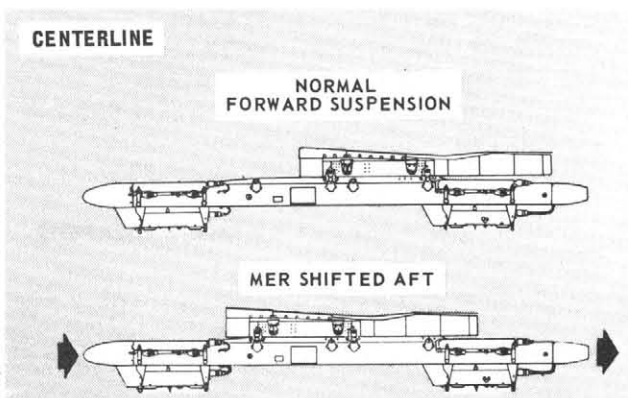
4C–34–1–1–(141–1)

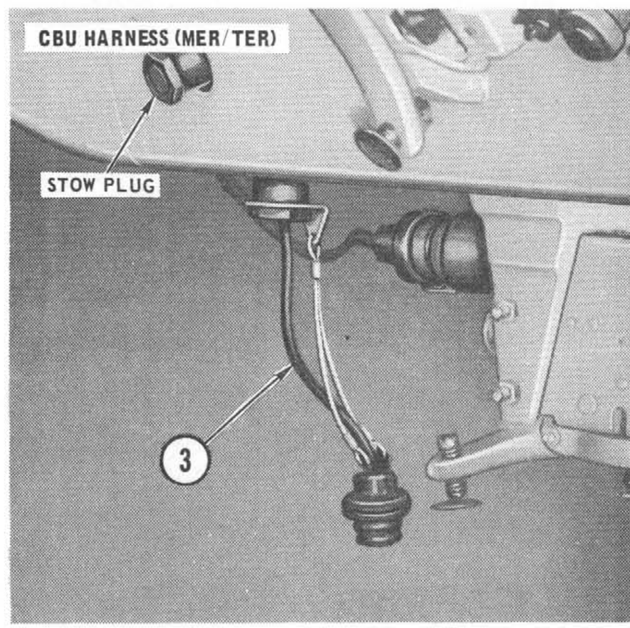
Figure 2-23 (Sheet 1 of 7)

EXTERIOR INSPECTION (CONTINUED)

DISPENSERS





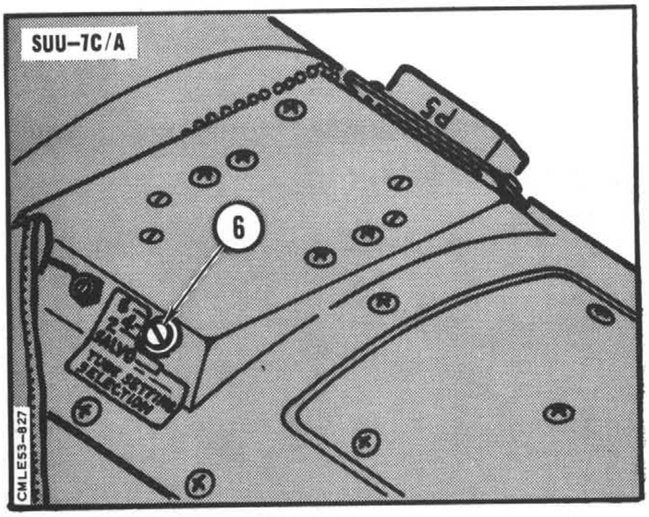


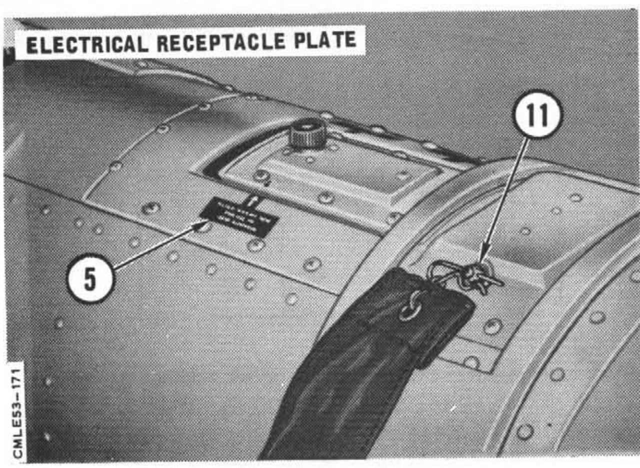
F4-34-11-403-2

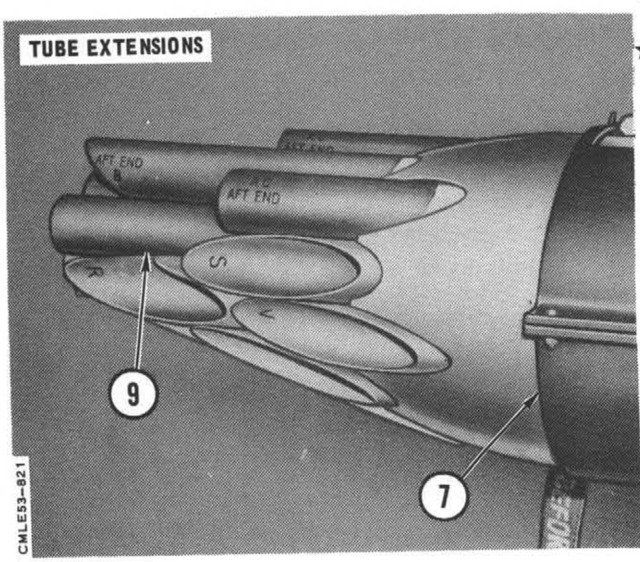
Figure 2-23 (Sheet 2 of 7)

EXTERIOR INSPECTION (CONTINUED)

DISPENSERS







SUU-7 DISPENSERS and BOMBS

SUU-	CBU-	BLU-
7A/A	1A/A	4A/B
7A/A	2/A	3/B
7A/A	2A/A	3/B
7B/A	2B/A	3/B
7C/A	2C/A	3/B
7A/A	9/A	BDU-28/B
7B/A	9A/A	BDU-28/B
7C/A	9B/A	BDU-28/B
7B/A	12/A	17/B
7C/A	12A/A	17/B
7C/A	46/A	66/B

★1. MER POSITION – **FORWARD**
2. MER AND TER SWITCH – **CBU**
3. CBU HARNESS (YELLOW) – **DISCONNECTED**
4. DISPENSER NOSE PLUG – **INSTALLED**
5. ELECTRICAL RECEPTACLE – **F100 OR F105 POSITION**
6. TUBE RELEASE SETTING – **RECORDED**
★7. BALLAST BAND – **INSTALLED (EXCEPT SUU-7C/A)**
8. EXPLOSIVE DETENTS – **SECURE**
★9. (CBU-1, -2) TUBE EXTENSIONS – **INSTALLED**
10. (SUU-7C/A) PUSH BUTTON SAFETY PIN – **INSTALLED**

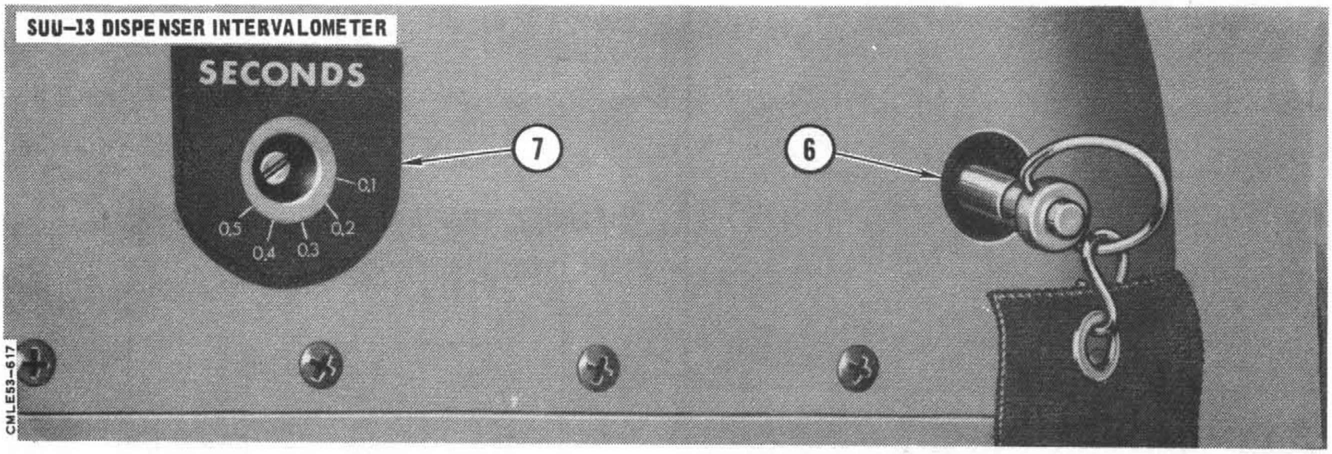
★SAFETY OF FLIGHT ITEM

4C-34-1-1-(141-3)

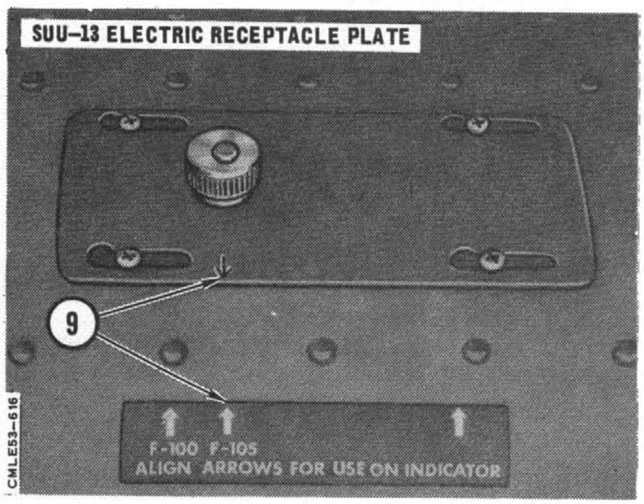
Figure 2-23 (Sheet 3 of 7)

EXTERIOR INSPECTION (CONTINUED)

DISPENSERS



SUU-13 DISPENSER INTERVALOMETER



SUU-13 ELECTRIC RECEPTACLE PLATE

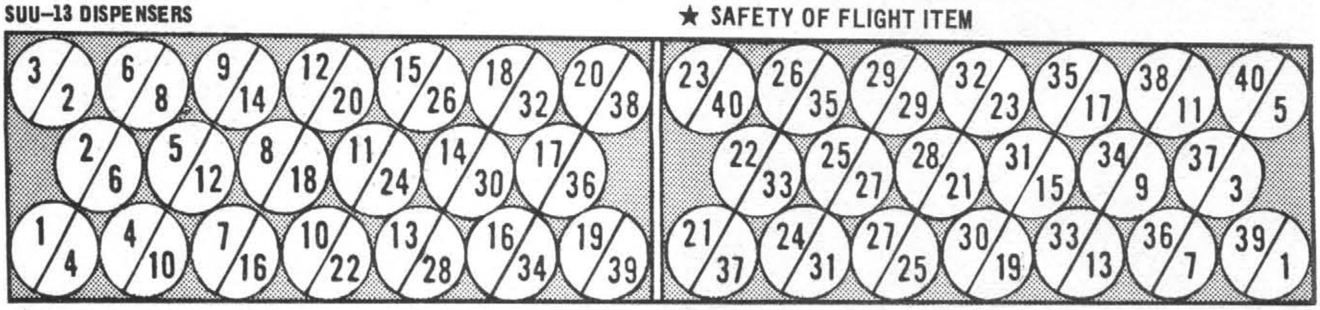
SUU-13 DISPENSERS & BOMBS

SUU–	CBU–	BLU–
13/A	30/A	39/B23
13A/A	7A/A	18/B
13A/A	38/A	49/B
13A/A	38A/A	49A/B

★1. MER POSITION – **FORWARD**
★2. LOAD CONFIGURATION– **RECORD FOR IN FLT REF.**
3. MER AND TER SWITCH – **CBU**
4. CBU HARNESS (YELLOW) – **DISCONNECTED**
5. DISPENSER SAFETY PALLET – **REMOVED**
6. DISPENSER INTERVALOMETER SAFETY PIN – **INSTALLED**
7. DISPENSER INTERVALOMETER – **SET AS REQUIRED**
8. REAR FAIRING ON FORWARD MER STATIONS – **REMOVED, OR BOBTAIL DESIGN**
9. ELECTRICAL RECEPTACLE– **F105 POSITION**

★ SAFETY OF FLIGHT ITEM

SUU-13 DISPENSERS



FORWARD

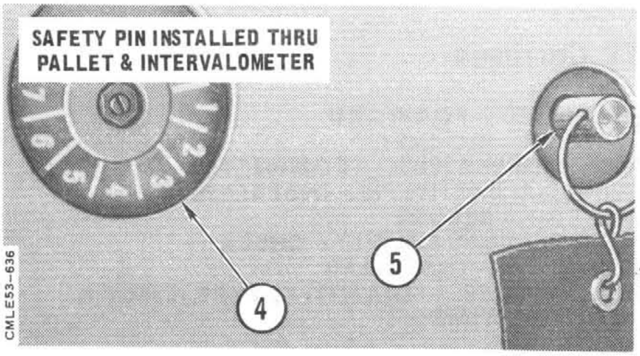
BOTTOM VIEW

4C-34-1-1-(141-4)

Figure 2-23 (Sheet 4 of 7)

EXTERIOR INSPECTION (CONTINUED)

DISPENSERS

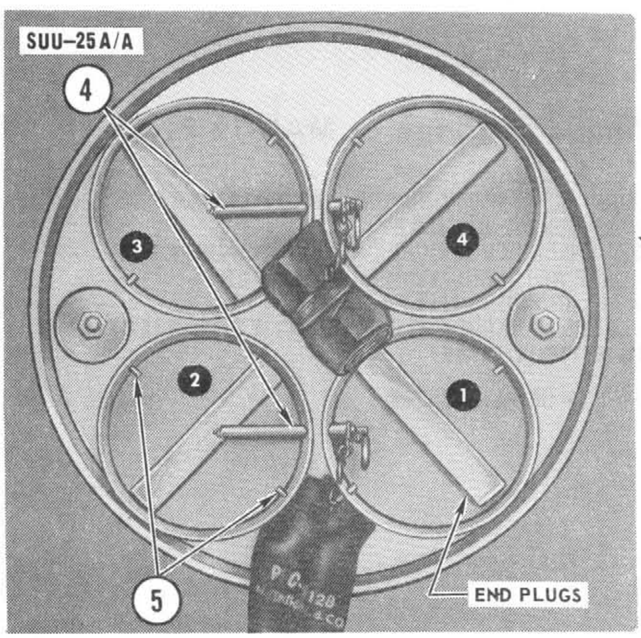


SUU-38 DISPENSERS & BOMBS

SUU-	CBU-	BLU-	KMU-
38/A	42/A	54/B	338/B

★ 1. MER POSITION – **(STA 1/9) AFT. (STA 5) FWD**
2. MER AND TER SWITCH – **CBU**
3. CBU HARNESS (YELLOW) – **CONNECTED**
4. INTERVALOMETER – **SET AS REQUIRED**
5. DISPENSER INTERVALOMETER SAFETY PIN – **INSTALLED**
6. ELECTRICAL RECEPTACLE – **F105 POSITION**
7. DISPENSER SAFETY PALLET – **REMOVED**

★ SAFETY OF FLIGHT ITEM



SUU-25A/A FLARE DISPENSER

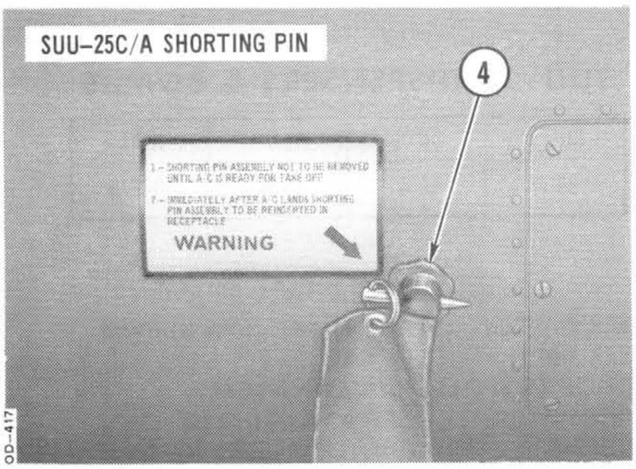
★ 1. MER POSITION – **FORWARD**
2. MER SWITCH – **ROCKET**
3. ROCKET HARNESS (BLUE) – **CONNECTED**
4. DISPENSER TUBE SAFETY PINS (2) – **INSTALLED**
5. EXPLOSIVE DETENTS (8) – **INSTALLED SEATED**
6. FLARES/MARKERS – **QUANTITY, TYPE, EJECTION & IGNITION TIME**

4C-34-1-1-(141-5

Figure 2-23 (Sheet 5 of 7)

EXTERIOR INSPECTION (CONTINUED)

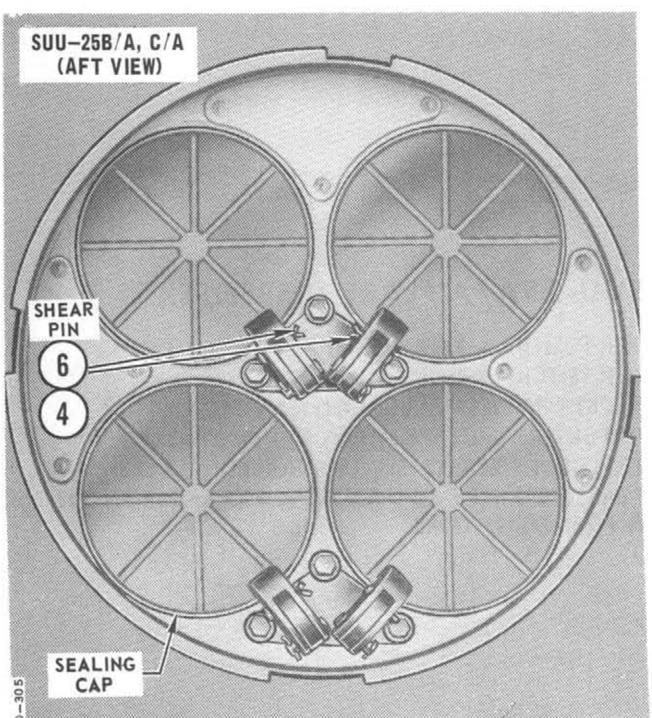
DISPENSERS



SUU-25B/A, C/A FLARE DISPENSER

MER Carriage

★ 1. MER SHIFTED - **FORWARD**
2. MER SWITCH - **ROCKET**
3. ROCKET HARNESS (BLUE) - **CONNECTED**
4. (SUU-25C/A) SHORTING PIN - **INSTALLED**
5. NOSE CONE - **SECURE**
6. FLARE RETAINING ASSEMBLY - **CHECK**
   a. SHEAR PINS - **INSTALLED**
7. FLARES/MARKERS - **QUANTITY, TYPE, EJECT & IGNITION TIME**



Single Carriage on MAU-12 Pylon

1. (SUU-25C/A) SHORTING PIN - **INSTALLED**
2. NOSE CONE - **SECURE**
3. DISPENSER ELECTRICAL CABLE - **CONNECTED**
4. FLARE RETAINING ASSEMBLY - **CHECK**
   a. SHEAR PINS - **INSTALLED**
5. FLARES/MARKERS - **QUANTITY, TYPE, EJECT & IGNITION TIME**

★ SAFETY OF FLIGHT ITEM

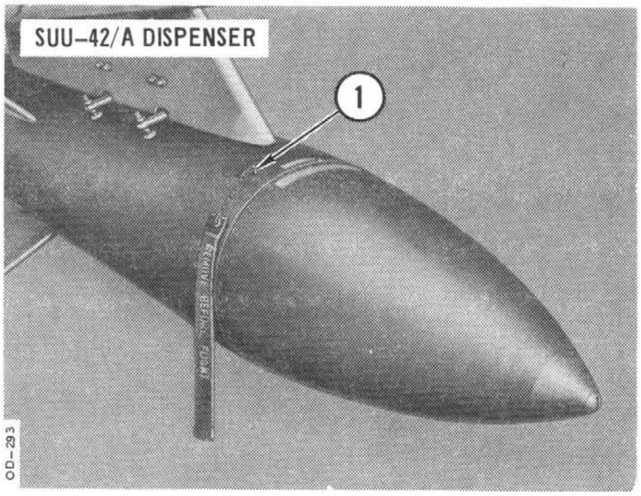
4C-34-1-1-(141-6)

Figure 2-23 (Sheet 6 of 7)

EXTERIOR INSPECTION

DISPENSERS

(CONTINUED)



SUU-42/A FLARE DISPENSER

1. DISPENSER SAFETY PIN – **INSTALLED**
2. DISPENSER SELECTOR SWITCH – **SINGLE OR RIPPLE**
3. DISPENSER INTERVALOMETER – **RECORDED**
4. DISPENSER CABLE – **CONNECTED, SECURE**
5. MAU-12 EJECTOR FEET – **SEATED AGAINST WEAPON**
6. FLARES – **QUANTITY, TYPE, EJECTION & IGNITION TIME**
7. ★ MAU-12 EJECTOR CARTRIDGES – **INSTALLED**
8. ★ DISPENSER FINS – **SECURE, NOT BENT**

★ SAFETY OF FLIGHT ITEM

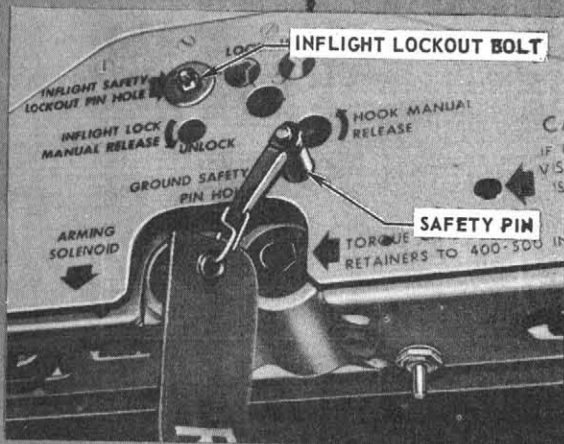
.–-34-1-1-(141-7)

Figure 2-23 (Sheet 7 of 7)

☆ U.S. GOVERNMENT PRINTING OFFICE: 1973— 769-640/196

EXTERIOR INSPECTION

SPRAY TANK A/B 45Y-1, -2, 4, PAU-7/A & TMU-28/B



SPRAY TANK SAFETY PIN, A/B 45Y-1

SPRAY TANK SAFETY PIN PAU-7/A & TMU-28/B

WARNING

THE TMU-28/B LIQUID AGENT SPRAY TANK CONTAINS A VX AGENT WHICH IS HIGHLY TOXIC AND CAN CAUSE DEATH TO PERSONNEL. VX IS ONE OF THE "V" SERIES NERVE GASES AND IS CLASSED AS A PERSISTENT LETHAL AGENT. THE AIRCREW MUST NOT MAKE PHYSICAL CONTACT WITH THE SPRAY TANK UNLESS WEARING IMPERMEABLE RUBBER GLOVES.

SUSPENSION EQUIPMENT

1. ARMAMENT PYLON – **CHECK**
   a. PYLON SAFETY PIN – **INSTALLED**
   ★b. EJECTOR CARTRIDGES – **INSTALLED**
   c. INFLIGHT SAFETY LOCKOUT PIN – **INSTALLED**
   d. LOCK INDICATOR – **UNLOCKED**
   e. SWAY BRACES – **TIGHTENED**

SPRAY TANK (A/B45Y-1, -2, -4)

1. (Y-1, Y-4) SAFETY PIN – **INSTALLED**
   SAFETY PIN MUST BE REMOVED BEFORE FLIGHT
★2. TANKS – **SECURE, PROPER STATION, CONDITION**

SPRAY TANK (PAU-7/A & TMU-28/B)

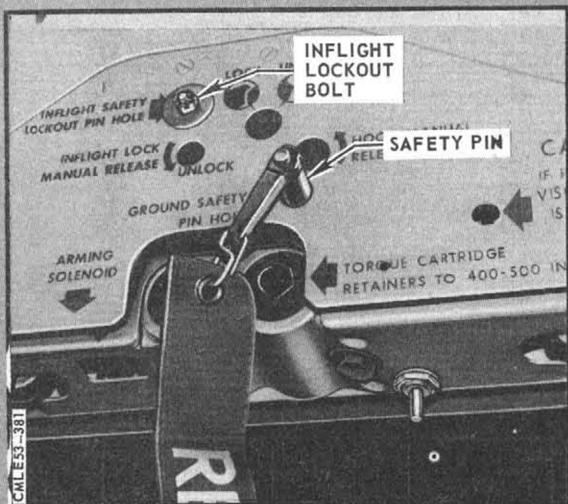
1. SPRAY TANK SAFETY PIN – **INSTALLED**
2. SPRAY TANK – **SECURE, PROPER STATION, CONDITION**
★3. BOTTOM TWO FINS – **REMOVED**
★4. BOOM – **RETRACTED**

4C-34-1-1-(142)

Figure 2-24

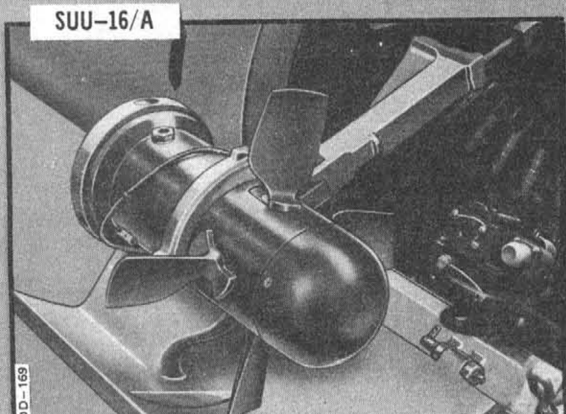
EXTERIOR INSPECTION

SUU-16/A, -23/A GUN POD



SUU-16/A

SUU-16/A



1. ARMAMENT PYLON – **CHECK**
   a. PYLON SAFETY PIN – **INSTALLED**
   b. EJECTOR CARTRIDGES – **INSTALLED**
   c. INFLIGHT SAFETY LOCKOUT PIN – **INSTALLED**
   d. LOCK INDICATOR – **UNLOCKED**
   e. SWAY BRACES – **TIGHTENED**
2. CENTERLINE RACK – **CHECK**
   a. SAFETY PIN – **INSTALLED (REMOVED PRIOR TO ENGINE START)**
   b. EJECTOR CARTRIDGES – **INSTALLED**
   c. SWAY BRACES ON CENTERLINE ADAPTER – **TIGHTENED**

SUU-16/A, -23/A GUN POD

1. AMMUNITION – **LOADED**
2. GUN FIRING LEAD – **DISCONNECTED**
3. RAT LEAD – **DISCONNECTED (SUU-16/A)**
4. (TRAINING) ROUNDS COUNTER – **CHECK RECORD**
5. RAT BLADES – **CHECK (SUU-16/A)**
6. STARTER MOTOR LEAD – **DISCONNECTED(SUU-23/A)**
7. RAT DOOR – **CLOSED (SUU-16/A)**

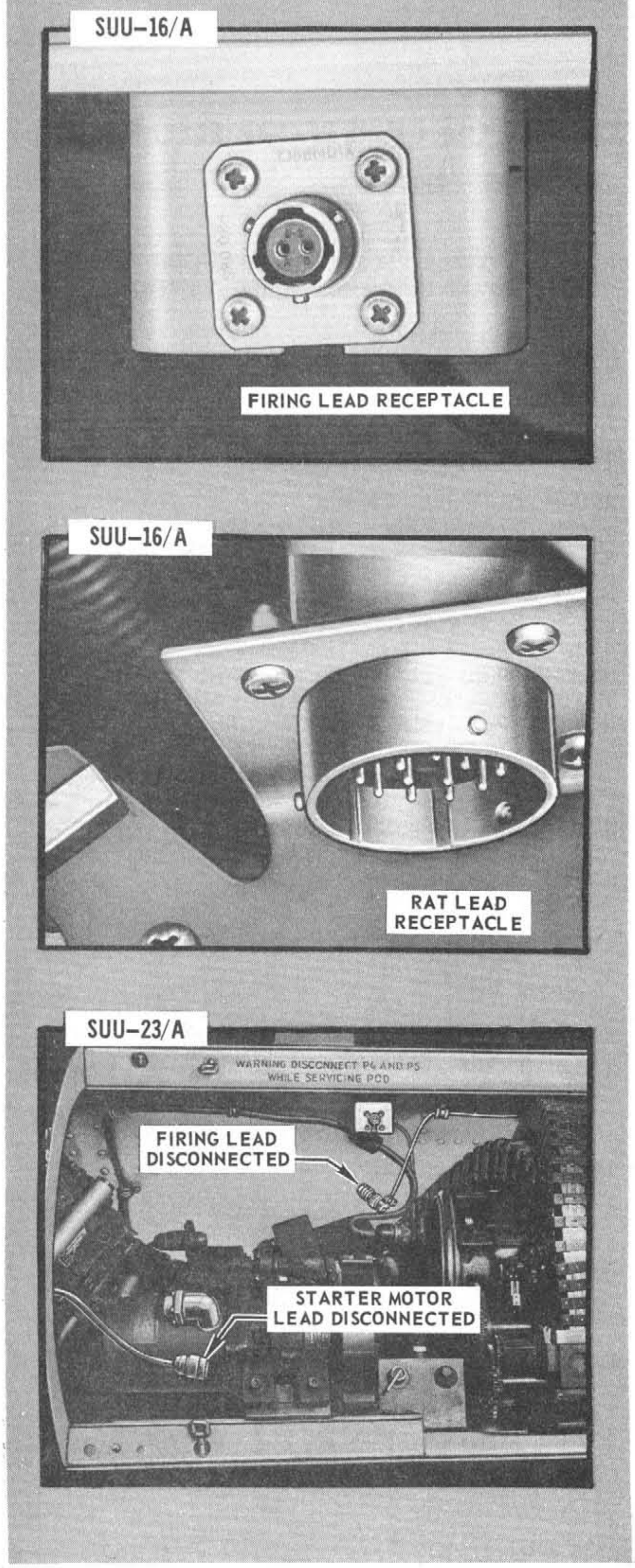
4C-34-1-1-(144-1)

Figure 2-25 (Sheet 1 of 2)

EXTERIOR INSPECTION

SUU-16/A,-23/A GUN POD

(CONTINUED)

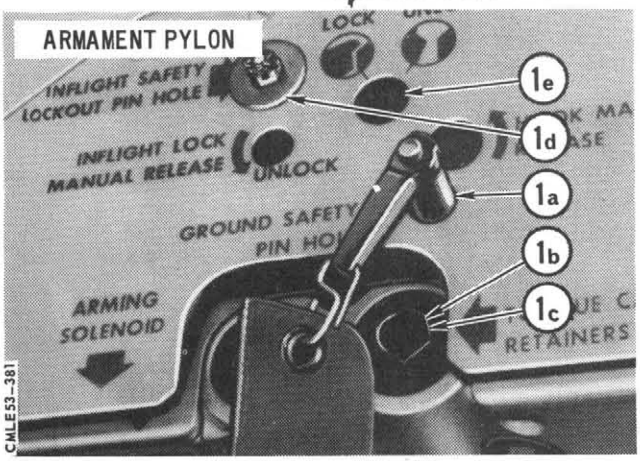


4C-34-1-1-(144-2)

Figure 2-25 (Sheet 2 of 2)

EXTERIOR INSPECTION

AGM-12B/C/E MISSILE



COCKPIT CHECK (BEFORE ELEC PWR)

1. AF FORM 781 – **CHECK**

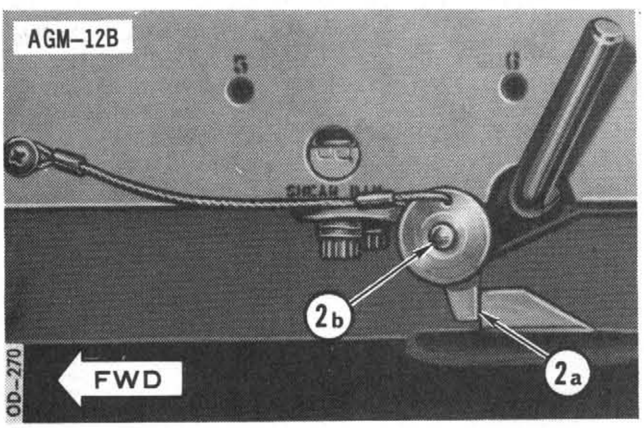
Note

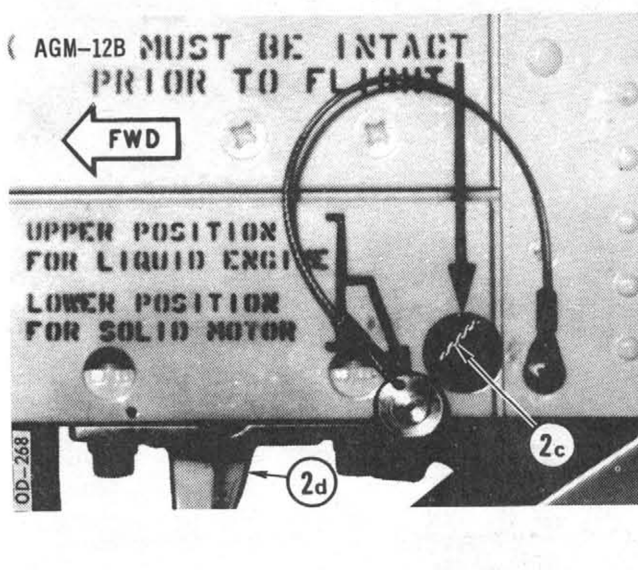
CHECK CRYSTALS (RECEIVER AND TRANSMITTER) INSTALLED AND MATCH MISSION REQUIREMENTS.

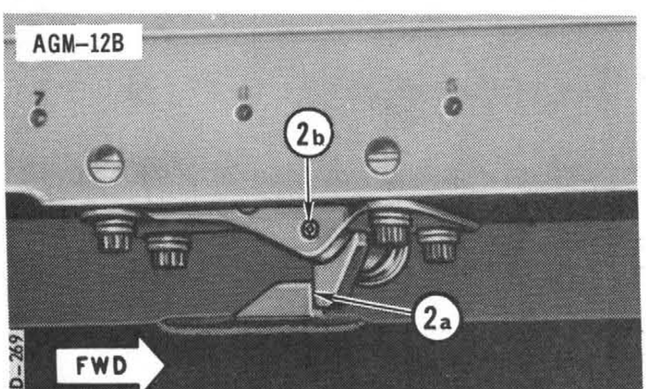
2. AF FORM 259 – **CHECK**
3. PERFORM CHECKS IN FIGURE 2–20A.

EXTERIOR INSPECTION

1. ARMAMENT PYLON – **CHECK**
   a. PYLON SAFETY PIN – **INSTALLED**
   b. (AGM–12B) EJECTION CARTRIDGES – **REMOVED**
   c. (AGM–12C/E) EJECTOR CARTRIDGES – **INSTALLED**
   d. INFLIGHT SAFETY LOCKOUT PIN – **INSTALLED**
   e. LOCK INDICATORS – **UNLOCKED**
   f. SWAY BRACES – **TIGHTENED**
2. (AGM–12B) LAU–34 LAUNCHER – **CHECK**
   a. FORWARD MISSILE STOP – **FLUSH WITH DETENT**
   b. SHEAR PIN – **INSTALLED**
   c. JETTISON GUN PISTON SAFETY WIRE – **INSTALLED**
      THE JETTISON GUN PISTON MUST BE SAFETYWIRED AND LOCKED IN THE FULL AFT POSITION.
   d. AFT LAUNCHER LINK–LOCK – **DOWN**







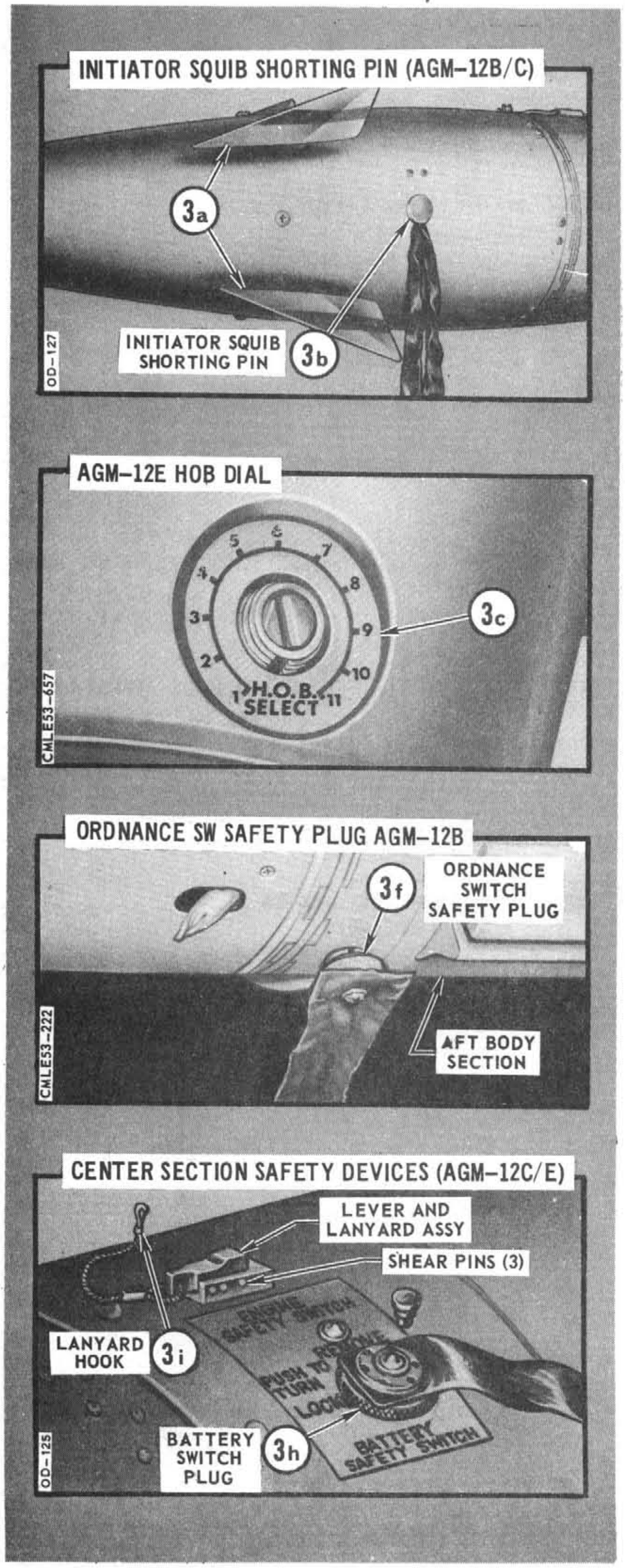
4C–34–1–1–(143–1)

Figure 2-26 (Sheet 1 of 3)

EXTERIOR INSPECTION

AGM-12B/C/E MISSILE

(CONTINUED)



3. MISSILE – **CHECK**
   a. CANARDS – **SECURE**
   b. INITIATOR SQUIB SHORTING PIN – **INSTALLED**
   c. (AGM-12E) HOB DIAL – **SET**
   d. FORWARD AND AFT LOCK RING ASSEMBLIES – **SECURE**
   e. UMBILICAL CABLE – **INSTALLED**
   f. (AGM-12B) ORDNANCE SAFETY PLUG – **INSTALLED**
   g. LIVE (ENGINE) IGNITOR – **INSTALLED**

      ENSURE DUMMY IGNITOR IS REMOVED AND LIVE IGNITOR INSTALLED.

   h. (AGM-12C/E) BATTERY SWITCH PLUG – **INSTALLED**
   i. (AGM-12C/E) ENGINE SAFETY SWITCH LEVER LANYARD – **CONNECTED TO BOMB RACK**

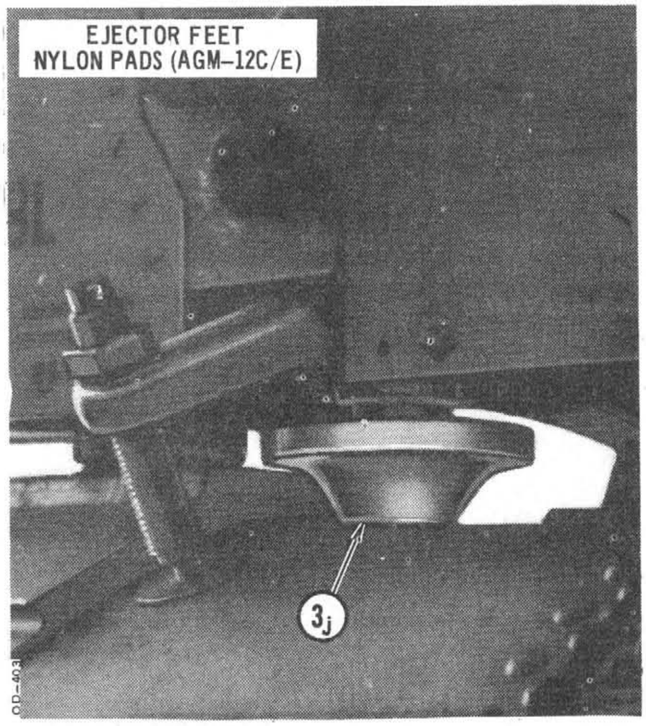
4C-34-1-1-(143-2)

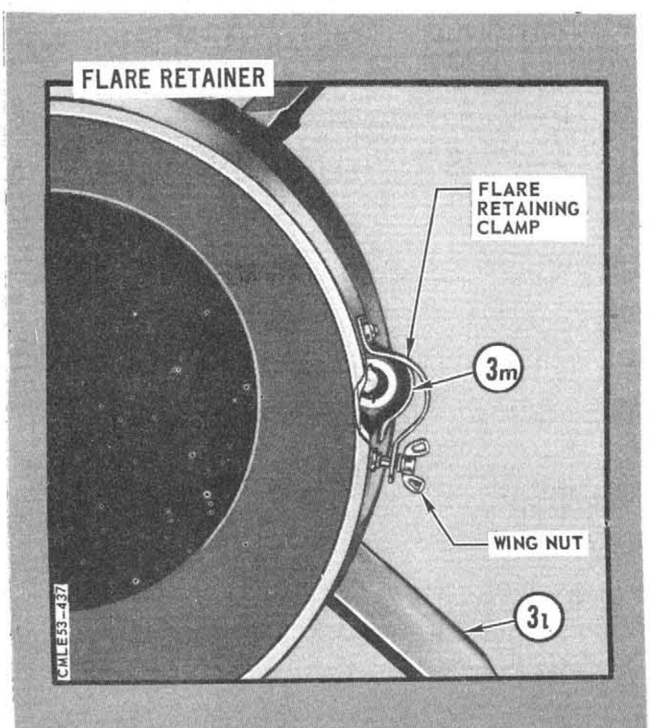
Figure 2-26 (Sheet 2 of 3)

EXTERIOR INSPECTION

(CONTINUED)

AGM-12B/C/E MISSILE





j. (AGM-12C/E) EJECTOR FEET NYLON PADS – **INSTALLED**

Note

IF NYLON PADS ARE NOT INSTALLED,
THE AGM-12C/E MISSILE MAY EXPERIENCE
ERRATIC FLIGHT AFTER LAUNCH.

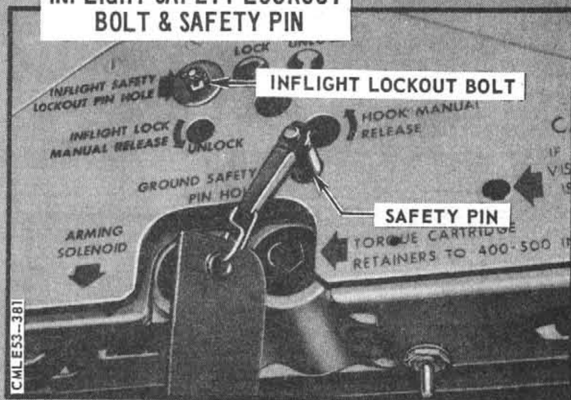
k. ENGINE – **CLEAN NO LEAKS**
l. MISSILE WINGS – **SECURE**
m. TRACKING FLARES – **SECURE**

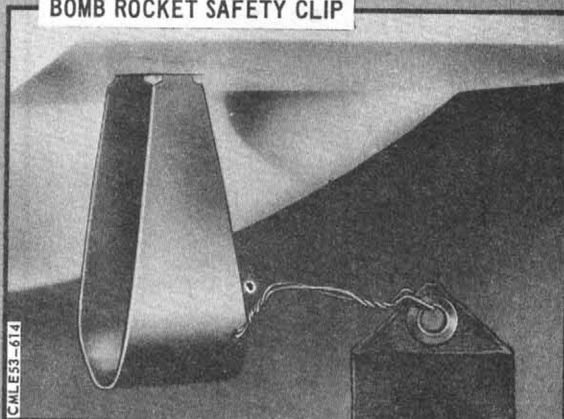
.C-34-1-1-(143-3)

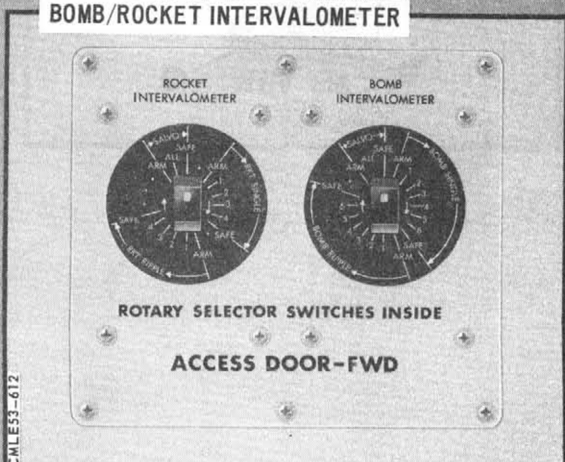
Figure 2-26 (Sheet 3 of 3)

EXTERIOR INSPECTION

SUU-20/A, & -20A/A BOMB ROCKET DISPENSER







SUSPENSION EQUIPMENT

1. ARMAMENT PYLON – **CHECK**
   a. PYLON SAFETY PIN – **INSTALLED**
   b. EJECTOR CARTRIDGES – **INSTALLED/REMOVED**
   c. INFLIGHT SAFETY LOCKOUT PIN – **INSTALLED**
   d. LOCK INDICATOR – **UNLOCKED**
   e. SWAY BRACES – **TIGHTENED**

Note

WHEN ROCKETS ARE CARRIED IN THE SUU–20, JETTISON CAPABILITY IS REQUIRED, THE EJECTOR CARTRIDGES MUST BE INSTALLED IN THE ARMAMENT PYLON, AND THE INFLIGHT LOCKOUT PIN (BOLT) MUST BE INSTALLED. JETTISON IS ACCOMPLISHED THROUGH THE MISSILE STATUS PANEL.

DISPENSER CHECK

1. BOMBS/ROCKET SAFETY CLIP - **INSTALLED(RED FLAG)**
2. BOMB AND ROCKET INTERVALOMETERS – **SAFE (PRECEDING SINGLE)**

Note

ROTATE THE INTERVALOMETER CLOCKWISE ONLY.

3. (20/A) BOMB RETAINING LOCKS – **INSTALLED (BDU-33/B ONLY)**
4. (20A/A) EJECTOR GUN SAFETY PIN – **INSTALLED**
5. BOMBS – **SECURE**
6. ROCKETS - **SECURE,SEATED AGAINST FIRING PROBE**
7. ROCKET FIN RETAINER – **PLASTIC ONLY**

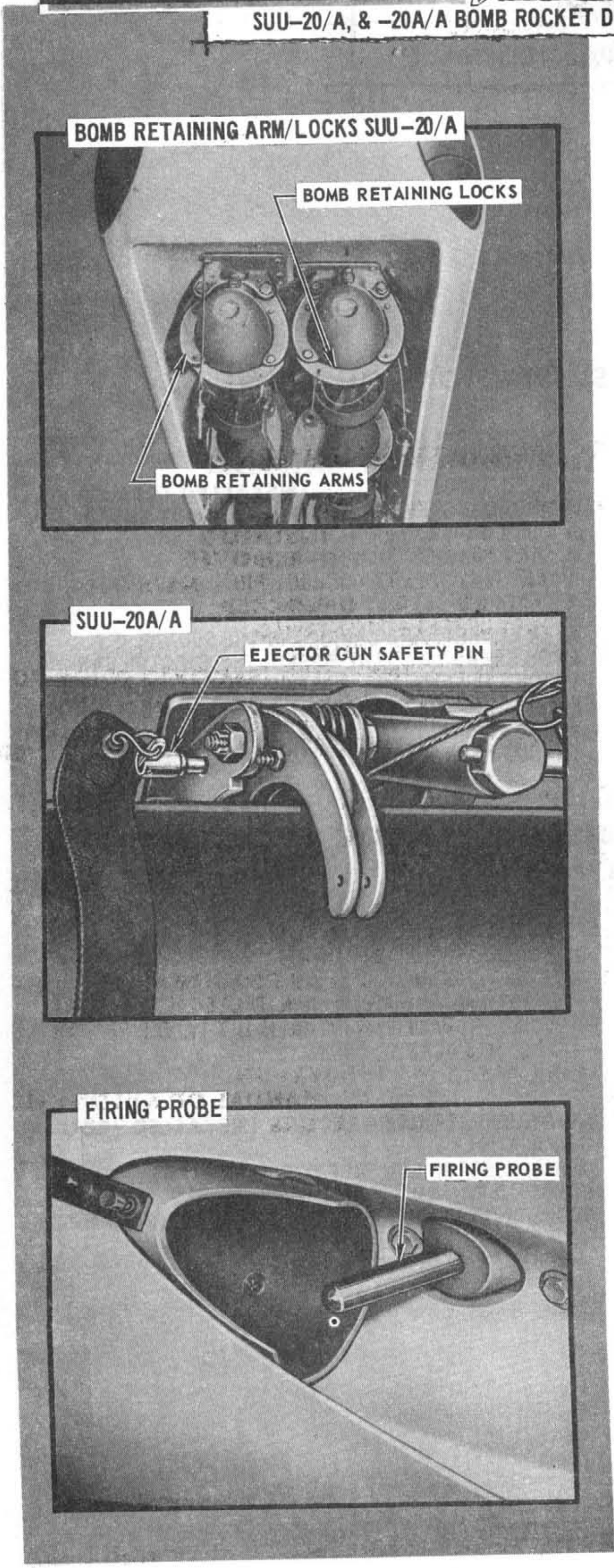
4C–34–1–1–(145–1)

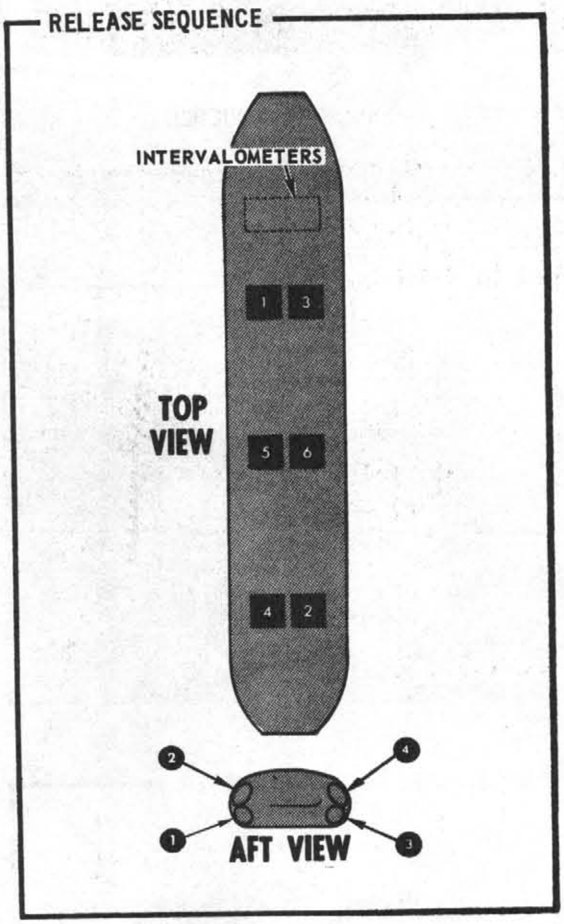
Figure 2-27 (Sheet 1 of 2)

EXTERIOR INSPECTION

SUU-20/A, & -20A/A BOMB ROCKET DISPENSER

(CONTINUED)



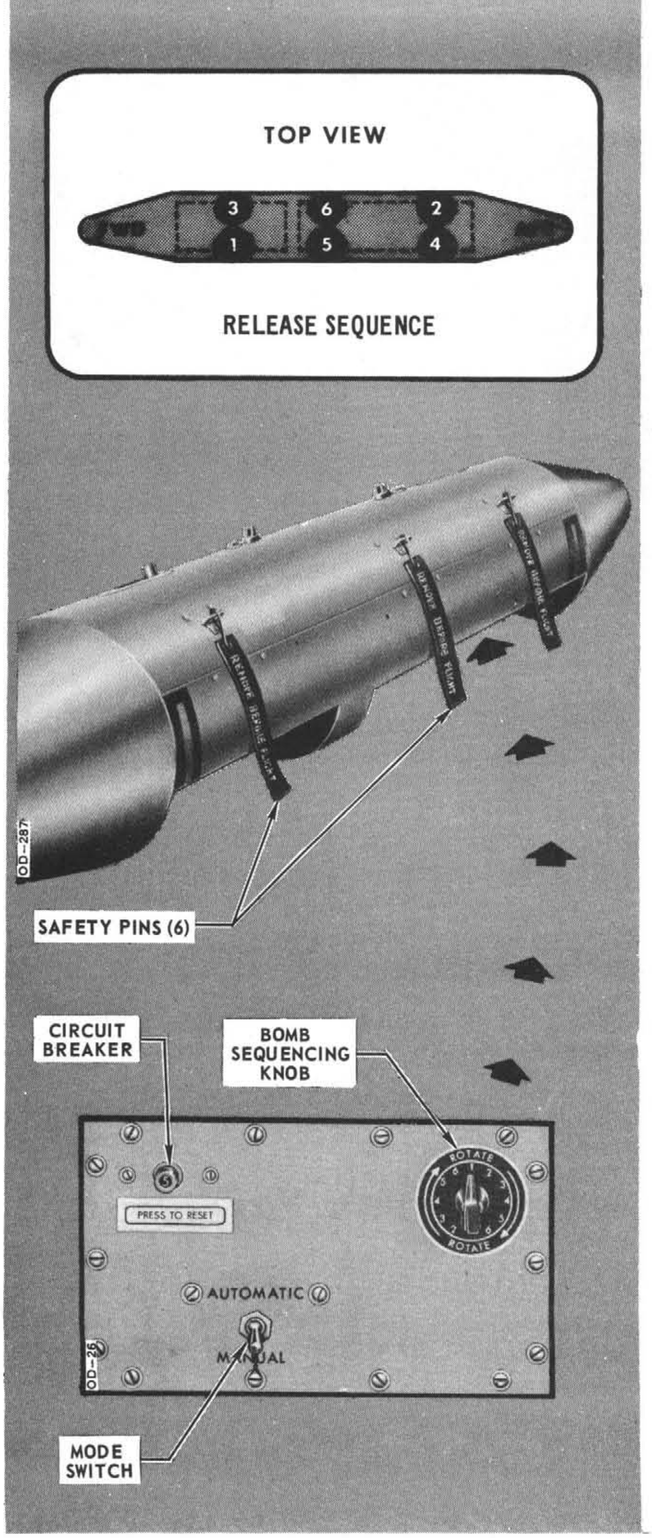


4C-34-1-1-(145-2)

Figure 2-27 (Sheet 2 of 2)

EXTERIOR INSPECTION

SUU-21/A BOMB DISPENSER



SUSPENSION EQUIPMENT

1. ARMAMENT PYLON – **CHECK**
   a. PYLON SAFETY PIN – **INSTALLED**
   b. EJECTOR CARTRIDGES – **REMOVED**
   c. INFLIGHT SAFETY LOCKOUT PIN – **CHECK**
      (1) CONVENTIONAL WPNS MISSION – **INSTALLED**
      (2) DCU–94/A MISSION – **NOT INSTALLED**
   d. LOCK INDICATOR – **AS REQUIRED**
   e. SWAY BRACES – **TIGHTENED**
2. CENTERLINE RACK – **CHECK**
   a. SAFETY PIN – **INSTALLED (REMOVED PRIOR TO ENGINE START)**
   b. EJECTOR CARTRIDGES – **REMOVED**
   c. SWAY BRACES ON CENTERLINE ADAPTER – **TIGHTENED**

DISPENSER CHECK

THESE PROCEDURES ASSUME THAT THE DISPENSER DOORS ARE OPEN

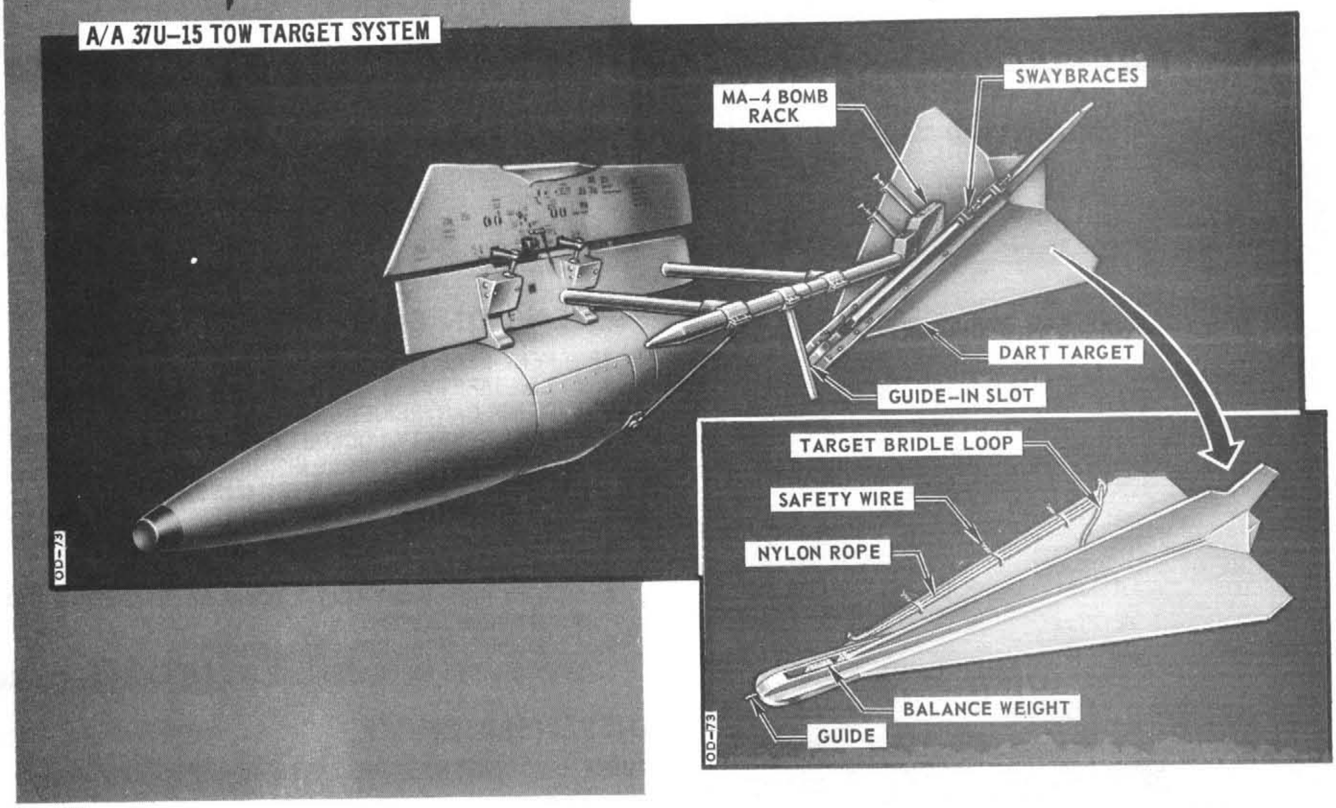
1. SAFETY PINS (6) – **INSTALLED**
2. RACK SWAY BRACES – **SECURE**
3. PRACTICE BOMBS – **SECURE**
4. BOMB SEQUENCING KNOB – **AS REQUIRED**
   IF LESS THAN 6 BOMBS ARE INSTALLED, CHECK THAT THE BOMB SEQUENCING KNOB IS SET ON THE PROPER RELEASE SEQUENCE.
5. DISPENSER CIRCUIT BREAKER – **IN**
6. DISPENSER MODE SWITCH – **MANUAL OR AUTOMATIC**
7. ALL ACCESS PANELS – **SECURE**

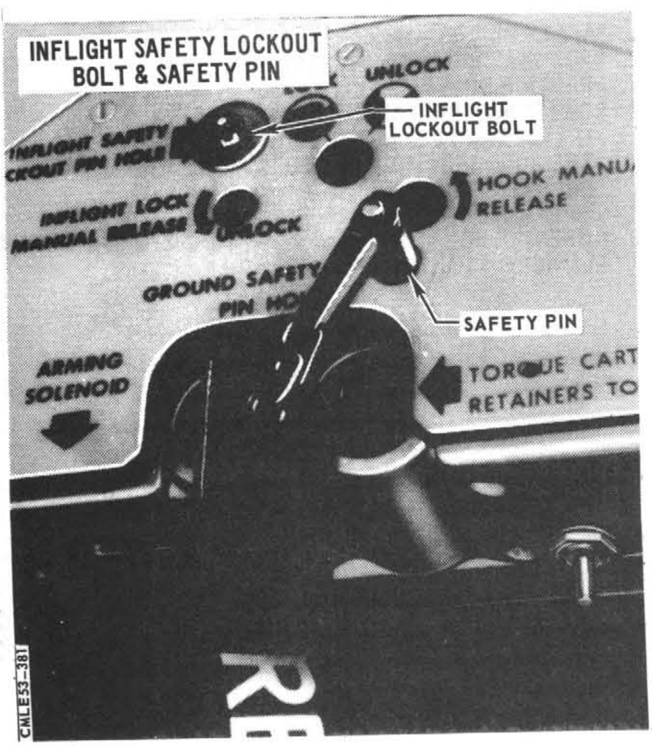
4C-34-1-1-(146)

Figure 2-28

EXTERIOR INSPECTION

MODIFIED A/A 37U-15 TOW TARGET SYSTEM





SUSPENSION EQUIPMENT

★1. ARMAMENT PYLON EJECTOR CARTRIDGES – **NOT INSTALLED**
★2. MA-4 BOMB RACK – **LOCKED**
★3. SWAYBRACE – **IN PLACE & SECURE**
★4. BALANCE WEIGHT GUIDE IN GUIDE SLOT.
5. ARMAMENT PYLON SAFETY PIN – **INSTALLED**
6. ARMAMENT PYLON SAFETY LOCK-OUT PIN (BOLT) – **INSTALLED**
7. ARMAMENT PYLON LOCK INDICATOR – **UNLOCKED**

TARGET (TDU-10/B)

★1. CABLE AND ROPE -**SECURE WITH TAPE & LOCKWIRE**
2. TARGET – **NOT DAMAGED**

★ SAFETY OF FLIGHT ITEMS

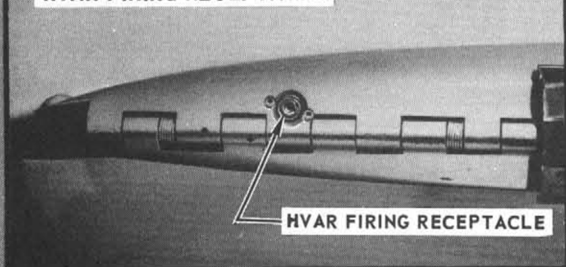
4C-34-1-1-(147)

Figure 2-29

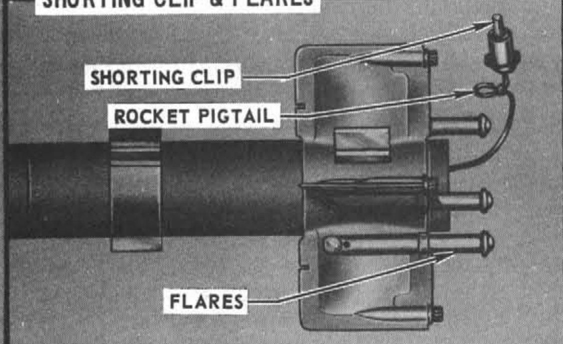
EXTERIOR INSPECTION

TDU-11/B TARGET ROCKET 5-INCH HVAR

HVAR FIRING RECEPTACLE



SHORTING CLIP & FLARES



1. LOAD CONFIGURATION – **AS REQUIRED**
2. ROCKET – **SECURE**
3. SHORTING CLIP – **INSTALLED**
4. PIGTAIL – **TAPE TO LAUNCHER**
5. TRACKING FLARES – **SECURE**

WARNING

AERO 3/B LAUNCHER SAFETY PIN DOES NOT SAFE LAUNCHER WHEN TDU-11B IS INSTALLED.

4C-34-1-1-(148)

Figure 2-30

"All data on pages 2-100AK thru 2-100AN deleted."

(UTS) AN/AWM-19 (F-4C/D/E)

PREFLIGHT

COCKPIT CHECK (BEFORE ELEC-PWR)

1. AF Form 781 - CHECK
2. Wing station jettison switch - NORMAL

CAUTION

The external wing tanks can be jettisoned by the external wing tank jettison switch any time electrical power is on the aircraft.

3. Internal wing dump switch - NORMAL

CAUTION

With electrical power applied to the aircraft, wing fuel will be dumped any time the internal wing dump switch is in the DUMP position.

4. Gear handle - DOWN
5. Missile arm switch - SAFE
6. Master arm switch - SAFE
7. Generator switches - OFF

CAUTION

Do not place the generator control switches to EXT ON until external power has been connected and has reached rated voltage and frequency.

EXTERIOR INSPECTION

If the AN/AWM-19 umbilical test set is installed on one or more of the missile stations, perform the following checks:

1. Aero 7A launcher safety pin - INSTALLED (figure 2-31).
2. Ejection squibs - REMOVED
3. Flag indicators - NO GO (All Black) (figure 2-32).

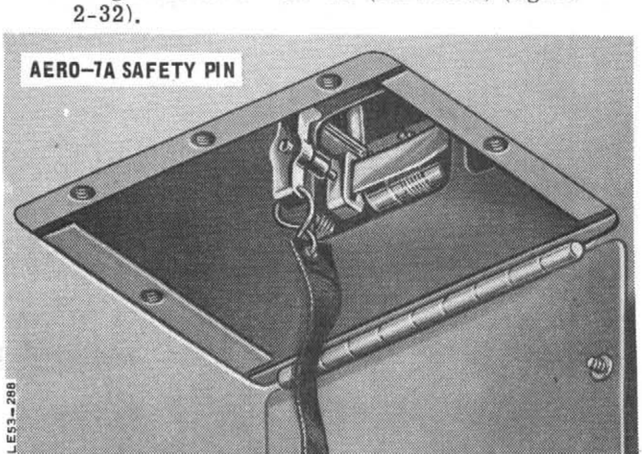


Figure 2-31

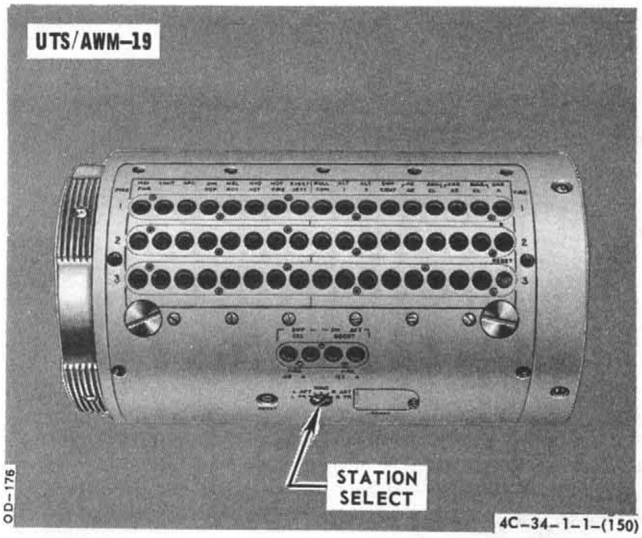


Figure 2-32

4. Motor fire connector connected to AN/AWM-19 (not missile motor).

Note

If the flag indicators are tripped (white dots), the UTS must be reset.

5. Station selector - AN/AWM-19 STATION (figure 2-32)
6. Reset UTS if required.
   a. Power applied to aircraft.
   b. (P) Radar power - TEST
   c. Missile select switch - RADAR
   d. Missile power switch - STBY for 15 SEC
   e. Missile power switch - PWR ON
   f. After radar times in (30 sec) have crew chief push AWM-19 reset button.

INTERIOR INSPECTION

Armament Area (Arming)

1. Armament switches - OFF or SAFE
2. Armament safety override button - PUSH IN

WARNING

When the armament safety override button is energized, the jettison circuit is placed in an inflight configuration, regardless of the landing gear handle position. The panic button will jettison all external stores. When the armament safety override button is pushed IN, the AC has a jettison capability during takeoff while weight is on the gear.

Note

Prior to the installation of ejector rack cartridges, a stray voltage check is performed by the armament crew. If the cartridges are installed with the engines running, the AC may push in the armament override button when a stray voltage check is required. The override button will pop out when the landing gear handle is raised.

3. Aircrew - HANDS IN VIEW
   The aircrew will place both hands in view as a signal to the armament crew to approach the aircraft. The armament crew may perform a stray voltage check and install the ejector cartridges. The crew will remove all safety pins and install all access covers.

INFLIGHT

To use the UTS against a live target use same procedures for launching a live missile as follows:

1. Missile arm switch - SAFE
2. Missile select switch - RADAR
3. Interlock switch - IN
4. (P) Radar power - OPR
5. (P) Gate switch - NAR
6. (P) Polar switch - LIN or CIR #1
7. (P) BIT checks - PERFORM
8. Missile power switch - STBY for 15 sec.
9. Missile power switch - PWR ON (select light ON)
10. (P) Radar search and lock-on - ACCOMPLISH
11. Attack steering - ACCOMPLISH
12. Missile arm switch - ARM (READY light ON)
13. Obtain IN RANGE light and aim dot within ASE circle.
14. Trigger switch - DEPRESS (Hold for 5 sec.)
15. Maintain tract to Break X or BREAK light.

Note

If more than one AWM-19 is loaded, repeat steps 8 thru 14 for each illuminated set of SELECT and READY lights.

16. Missile arm switch - SAFE
17. Missile power switch - OFF

CAUTION

Damage to the permanent magnet alternator in the UTS may result if the missile power switch is placed to OFF and then to PWR ON in less than 5 seconds.

18. Repeat steps 8 thru 17 if second run is desired.

BIT FIRING

1. (P) Radar power - TEST
2. Interlock switch - OUT
3. (P) Test switch - 6
4. (P) Obtain IN RANGE light.
   Position the range strobe to an in-range position.
5. Missile power switch - STBY for 15 sec.
6. Missile power switch - PWR ON (Select light ON)
7. Missile arm switch - ARM (Ready light ON)
8. Trigger switch - DEPRESS (Hold for 5 sec.)
   Repeat step 8 for each set of illuminated Select and Ready lights.
9. Missile arm switch - SAFE
10. Missile power switch - OFF

CAUTION

Damage to the permanent magnet alternator in the UTS may result if the missile power switch is placed to OFF and then to PWR ON in less than 5 seconds.

Note

The following steps will be performed on the fourth firing only.

11. (P) Test switch - 3
12. Gate switch - NAR
13. (P) Lock-on BIT target.
14. Missile power switch - STBY for 15 SEC.
15. Missile power switch - PWR ON (Select light ON)
16. Missile arm switch - ARM (Ready light ON)
17. Trigger switch - DEPRESS (Hold for 5 sec.)
    Repeat step 17 for each set of illuminated Select and Ready lights.
18. Missile arm switch - SAFE
19. Missile power switch - OFF

BEFORE LANDING

1. Master arm switch - SAFE
2. Station select - OFF
3. Guns & stores switch - NORMAL (F-4D/E)
4. Sight Mode selector knob - STBY, or CAGE (F-4D/E)
5. All DCU-94/A station selector switches (5) - AFT
6. Missile arm switch - SAFE
7. Missile power switch - OFF
8. Missile jett knob - OFF

ARMAMENT AREA (DE-ARMING)

1. Armament switches - OFF or SAFE
2. Aircrew - HANDS IN VIEW

RMU-8/A TOW TARGET SYSTEM (F-4C/D/E)

PREFLIGHT

COCKPIT CHECK (BEFORE ELEC PWR)

1. AF Form 781 - CHECK
2. Wing station jettison switch - NORMAL

CAUTION

The external wing tanks can be jettisoned by the external wing tank jettison switch any time electrical power is on the aircraft.

3. Internal wing dump switch - NORMAL

CAUTION

With electrical power applied to the aircraft wing fuel will be dumped any time the internal wing dump switch is in the DUMP position.

4. Gear handle - DOWN
5. Missile arm switch - SAFE
6. Master arm switch - SAFE
7. Generator switches - OFF

CAUTION

Do not place the generator switches to EXT ON until external power has been connected and has reached rated voltage and frequency.

Tow system operation is performed by the tow system operator (TSO) from the rear cockpit. This checklist covers those procedures to be followed by the tow system operator and AC after the ground crew has the tow system completely prepared for flight. The checklist will be followed step by step for all pre-operation and post-operation procedures. Operational procedures and malfunction procedures will be reviewed just prior to each operating sequence, and should be referred to as required during the sequence. Emergency procedures will be memorized and reviewed prior to each flight. Refer to the Flight Manual for operating limitations of the aircraft with the RMU-8/A Reel-Launcher and TDU-22 target installed.

Note

Procedural headings followed by TSO refer to the tow system operator and those left blank refer to the AC.

EXTERIOR INSPECTION (TSO) (FIGURE 2-33)

1. Target - SECURE
2. Target clamps - SNUG
3. Launcher - UP AND LOCKED
4. Towline length sensing unit - CHECK
   a. Launch stop - SET AS REQUIRED
   b. In stop - SET AS REQUIRED
   c. Out stop - SET AS REQUIRED
   d. Cable switch - OFF
5. N_2 pressure - 2000 to 3000 PSI
6. Auto-cut safety pin - REMOVED
   Removing the auto-cut safety pin allows the cutter arming switch to go to the spring loaded arm position.
7. Turbine - CHECK
   a. Condition of blades.
   b. Blades feathered.
   c. Brakes on.

WARNING

Turbine can reach 11,000 rpm in flight. Record all nicks or scratches deeper than 0.001 inch on the RMU-8/A maintenance forms. DO NOT operate reel-launcher until the discrepancy has been corrected and cleared for flight by the RMU-8/A maintenance crew chief.

8. All access panels - SECURED
9. Swaybraces - SECURE & SAFTIED

INTERIOR INSPECTION (TSO)

Before External Power is Connected

1. Tow system master switch - OFF
2. Emergency stop and cut switch guard - DOWN (OFF)
3. No. 3 circuit breaker panel - CHECK
   a. RMU-8/A EMER PWR circuit breaker (zone 10D) - IN
   b. RMU-8/A PWR circuit breaker (zone 11D) - IN
   c. RMU-8/A circuit breaker (zone 12D) - IN

With External Power Connected

4. RMU-8/A 15 amp circuit breaker on indicator panel - IN
5. Tow system master switch - ON
6. Test all tow system warning lights.
7. Check tow system warning lights.
   All warning lights should be out with the exception of the low oil pressure light.
8. Towline length counter - ZEROED
9. Towline speed indicator - ZERO
10. Towline tension - CHECK
    Check for preload of approximately 200 to 400 pounds.

BEFORE TAXIING (TSO TO AC)

1. Tow system ready - MASTER SWITCH ON (CALL)

INFLIGHT

TAKEOFF

1. Use normal operating procedures.
2. Towline tension - WITHIN LIMITS (1800 POUNDS MAX)

AFTER TAKEOFF-CLIMB

During Climb (TSO)

1. Towline tension - WITHIN LIMITS (1800 POUNDS MAX)

Note

The towline can be broken even with target stowed. Tow operator will advise AC to reduce airspeed and/or G if towline tension becomes critical.

TOW SYSTEM OPERATION

CAUTION

An aircraft towing a cable is highly susceptible to being struck by lightening. Targets should not be launched in the area of a thunderstorm.

LAUNCHING TARGET

1. Maintain straight and level attitude.
2. Launch altitude - 15,000 - 20,000 FEET
3. Optimum airspeed - 300 KCAS

REEL-OUT

1. Permissable during climb to mission altitude after the RMU-8/A reaches high speed reel-out of 4775 to 5220 feet per minute.
2. Maximum airspeed - 320 KCAS
3. Maximum bank angle - 15 DEGREES
4. Maximum nose up attitude - 12 DEGREES
5. Maximum engine RPM during climb to mission altitude - 95%

CRUISE

1. Maximum bank angle - 30 DEGREES
2. Airspeed should not exceed 350 KCAS
3. Normal airspeed - 300 KCAS

Note

If afterburner is required during a turn while target is deployed, use outside afterburner to prevent possibility of burning towline. Maximum EGT on inboard engine is 500° during all turns.

RMU-8/A REEL LAUNCHER

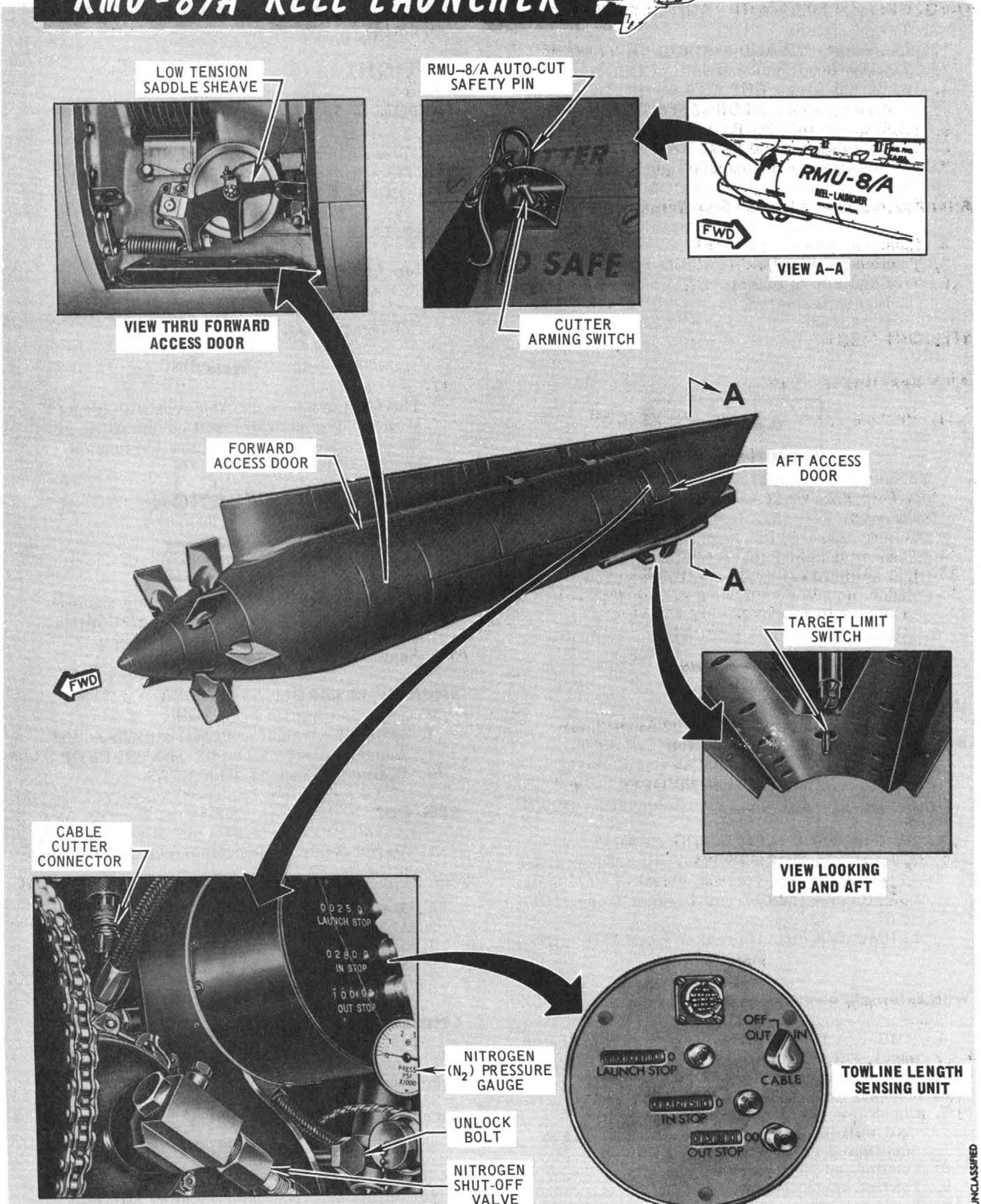


Figure 2-33

LAUNCHING TARGET

TARGET DEPLOYMENT WITH LAUNCH STOP (TSO)

1. Launch/recover switch - LAUNCH TARGET
2. Launcher down light - ON
3. Target out light - ON
4. Towline tension - DECREASES TO ZERO
5. Towline length - INCREASING
6. Towline speed - 600 FPM MAXIMUM
7. Disregard low oil pressure light during launch.

After Passing Preset Launch Stop Setting

8. Launcher down light - OFF
9. Towline speed - DECREASING TO ZERO
10. Tow oil pressure light - ON

REEL-OUT (TSO)

After Reel Has Stopped -

11. Reel-out/Reel-in switch - REEL-OUT

Note

Launcher may recycle if lightweight target is being used.

12. Towline length - INCREASING
13. Low oil pressure light - CHECK
    Light should go out when towline speed increases to approximately 2500 fpm.

CAUTION

Low oil pressure light should be extinguished prior to reaching a reel-out speed of 3500 fpm. If the light remains on as this speed is approached, the TSO should initiate a normal stop.

14. Cable tension - INCREASING
15. Towline speed - 5250 FPM
    Towline reaches reel-out speed in 40 plus or minus 5 seconds.

Note

Vibration may be noticable in the speed governing range above 4775 fpm.

After Passing Preset Out-Stop

16. Towline speed - DECREASING TO ZERO
17. Low oil pressure light - CHECK
    Light should illuminate when towline speed decreases to approximately 2500 fpm.

Note

See Emergency procedures if reel fails to stop at preset out-stop setting.

LAUNCHING TARGET

TARGET DEPLOYMENT UTILIZING DIRECT REEL-OUT CYCLE (TSO)

1. Reel-out/Reel-in switch - REEL-OUT
2. Launcher down light - ON
3. Target out light - ON
4. Towline tension - DECREASES TO ZERO
5. Towline length - INCREASING
6. Towline speed - 600 FPM MAXIMUM
7. Disregard low oil pressure light during launch cycle.

REEL-OUT

After Passing Preset Launch Stop Setting-

8. Launcher down light - OFF
9. Towline length - INCREASING
10. Towline speed - INCREASING
11. Low oil pressure light - CHECK
    Light should go out when towline speed increases to approximately 2500 fpm.

CAUTION

If the low oil pressure light is not extinguished when a towline speed of 3500 fpm is reached, a normal stop should be initiated.

12. Cable tension - INCREASING
13. Towline speed - 5250 FPM MAXIMUM

After Passing Preset Out-Stop Setting

14. Towline speed - DECREASING TO ZERO
15. Low oil pressure light - ON
    Low oil pressure light illuminates as the towline speed reaches approximately 2500 fpm
16. Towline speed - ZERO
    Towline speed should read zero after approximately 1800 feet of cable deployment after passing through preset out-stop. See emergency procedures if reel fails to stop.

TDU-22 A/B TARGET FLARE IGNITION PROCEDURES

Note

The UHF radio in the rear cockpit is utilized for flare ignition. The UHF frequency must be set to the same frequency as the command receiver in the target. A 10 second wait period is required between each target command transmission.

Target Flare Ignition Procedures (TSO)

Note

The target program relay must be stepped from the safe to the ready position before flare ignition can be accomplished. This may be accomplished during reel-out.

1. UHF command control light on UHF radio control panel - ON
2. UHF radio frequency - SET AS REQUIRED
3. UHF channel mode select - MANUAL
4. UHF transmit receive selector - T/R+G
5. UHF mic button and flare tone button - DEPRESSED FOR 5-10 SECONDS.
   Depress both buttons simultaneously.

Note

The above procedure will be utilized for each target command transmission. The target program relay has six positions for six commands. The sixth command will return the relay to the safe position for target recovery.

REEL-IN (WITH TARGET)

1. Permissible during descent in a straight and level flight, but not advisable during climb.
2. Maximum airspeed - 300 KCAS.
3. Optimum condition for descent is 250 KCAS to an altitude of 15,000 feet.
4. A minimum reel-in speed of 3700 fpm should be maintained by increasing airspeed or as advised by TSO.

REEL-IN (TSO)

Note

Cable tension during reel-in should not exceed 400 pounds less than the mission tension.

1. Reel-out/Reel-in switch - REEL-IN
2. Auto cut armed light - ON
3. Towline length - DECREASING
4. Low oil pressure light - CHECK
   Light should go out when towline speed reaches approximately 2500 fpm.

Note

If reel-in is with target attached, airspeed should be adjusted to maintain a minimum of 3700 fpm towline speed to prevent illumination of the low oil light.

5. Towline speed - 5250 FPM MAXIMUM

After Passing In-Stop Setting

6. Towline speed - DECREASING TO ZERO

TARGET RECOVERY

1. Permissable during straight and level flight or a maximum bank angle of 5°.
2. Maximum recommended airspeed - 300 KCAS
3. Recommended recovery altitude - 15,000 FEET
   a. Maximum recovery altitude - 20,000 FEET
   b. Minimum recovery altitude - 10,000 FEET

TARGET RECOVERY (TSO)

1. Notify AC to establish flight conditions as brief (300 KCAS, 15,000 feet altitude).
2. Launch/Recovery switch - RECOVER TARGET
3. Auto cut armed light - OFF
4. Launcher down light - ON

CAUTION

If a recovery is attempted directly after launch, immediately key recovery speed switch to INCREASE followed by actuation to DECREASE.

5. Recovery speed switch - AS REQUIRED FOR DESIRED RECOVERY RATE
   Actuate recovery speed switch as required to establish desired recovery rate (1100 fpm maximum, about 5 actuations to move target).
6. Towline length - DECREASING
7. Disregard low oil pressure light during recovery.
8. Towline speed - STABILIZED AT 150 FPM PRIOR TO FINAL 50 FEET.

When Target Reaches Launcher

9. Target out light - OFF
10. Launcher down light - OFF
11. Towline tension - CHECK
    Towline tension should be between 300 to 500 pounds.
12. Obtain confirmation from chase plane that launcher is up and clamps are closed about target.
13. Tow master switch - ON
    Leave tow master switch on to monitor cable tension for remainder of flight.

REEL-IN (WITH TARGET SHOT OFF)

1. Maintain 300 KCAS, and descend to an altitude of 15,000 feet.
2. Reel-in of towline is accomplished during descent to final recovery altitude.

REEL-IN (WITH TARGET SHOT OFF) (TSO)

1. Utilize normal reel-in procedures.

Final Recovery of Tow Cable Without Target

1. Permissable during climb.
   a. Maximum nose up attitude - 12 DEGREES
   b. Maximum nose down attitude - 20 DEGREES
2. Maximum bank angle - 5 DEGREES
3. Optimum airspeed - 300 KCAS
4. If no chase plane is available, towline should be cut after reel has stopped.
5. If chase plane is available, cable should be cut when whipping or balling occurs or when cable length is approximately 25 feet in length.

Towline Recovery (TSO)

1. Launch/recovery switch - RECOVER TARGET
2. Auto-cut armed light - OFF
3. Launcher down light - ON
4. Recovery speed switch - AS REQUIRED
5. Emergency stop and cut switch - STOP & CUT
   Actuate emergency stop and cut switch on command of chase plane.
6. Launcher down light - OUT
7. Towline speed - ZERO
8. Launcher up and tow cable cut, confirmed by chase plane.

LANDING

1. Use normal procedures, and touch down beyond arresting cable to preclude any chance of target engaging the cable.
2. (TSO) Tow master switch - OFF
   Turn tow master switch off after taxiing off runway.

BEFORE LEAVING AIRCRAFT (TSO)

1. RMU-8/A discrepancies entered on applicable forms.

SECTION III EMERGENCY AIRCREW PROCEDURES

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PART 1 EMERGENCY AIRCREW PROCEDURES F-4C

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EMERGENCY RELEASE PROCEDURES (F-4C)

Emergency Release is the term used when the normal bomb release system is employed; e.g., to release empty launchers or to expediently release weapons with the ripple release mode. All non-nuclear, air-to-ground weapons (with the exception of the gun pods and AGM missiles) will be released through the normal, non-nuclear weapons release mode. The suspension equipment should be retained during emergency conditions. Refer to jettison procedures when TIME is the overriding factor.

HUNG ORDNANCE

Hung ordnance is the term used when an unsuccessful attempt has been made to release or jettison a weapon from the aircraft.

WARNING

Following an attempted release or jettison, any non-nuclear weapon that does not separate from the aircraft, the weapon should be considered armed and susceptible to inadvertent release during landing. Under these circumstances, the aircrew should be prepared to make an immediate go-around in the event an inadvertent release of a hung store occurs during landing.

EMERGENCY BOMB, LAUNCHER, DISPENSER RELEASE

When an unsuccessful attempt has been made to release the weapon(s) from the MER or TER, recheck switch positions and repeat original release procedure. If weapon(s) release does not occur, perform the following:

1. Home MER/TER bomb racks.
   a. Weapons selector knob - RKTS & DISP
      The above step is not required for launcher and dispenser release.
2. Weapon selector knob - BOMB/RIPPLE
3. Arm nose-tail switch - SET AS REQUIRED
   The SAFE position is normally used.
4. Bomb button - DEPRESS (hold 4 seconds)
5. Repeat the above procedure if all bombs do not release.
6. If the weapon should not be returned to base, refer to jettison procedures.

JETTISON PROCEDURES (F-4C)

WARNING

Refer to T.O. 1F-4C-1 (Unclassified) for munition carriage and jettison restrictions on the aircraft. Classified limitations are provided in T.O. 1F-4C-34-1-1A.

The term jettison implies the use of the jettison controls or the normal release controls to clean the aircraft of suspension equipment, to launch missiles unguided or to release the missiles without motor ignition.

EMERGENCY JETTISON, MULTI-STATION

EXTERNAL STORE EMER RELEASE BUTTON

The external store emergency release button (panic button) is the most expedient means to clean the wing CL, and fuselage stations. The MAU-12 armament pylons cannot be jettisoned; however, the MER and TER, gun pods, AGM missiles (less the launcher), and weapons suspended directly from the pylons are jettisoned. Inboard wing mounted heat missiles or the 5-inch HAVR target are jettison-launched by motor ignition. Radar missiles are jettisoned.

WARNING

The AIM-9 missile should be considered armed and to have some guidance capability.

The following conditions must exist:

a. Inflight lockout pins installed in the MAU-12 armament pylons. DCU-94/A LO, RO, LI, and RI UNLOCKED lights illuminate.
b. (P) Emergency landing gear handle in or armament safety override button pushed in.
c. Weight off the gear or landing handle in the up position, or the armament safety override button pushed in.
d. TK light on for the centerline station.
e. Wing flap switch full up for the wing station missiles.
f. For bombs suspended directly from the armament pylons or a CL BRU-5A bomb rack, the master arm switch or the arm nose tail switch must be in SAFE if the bombs are to be jettisoned in the safe condition.

To jettison all external equipment, perform the following:

1. Master arm switch - SAFE (if applicable)
2. External stores emergency release button (panic button) - PUSH

SELECTIVE JETTISON

CENTERLINE STATION JETTISON

With the TK light ON, the equipment or weapon suspended from the BRU-5A bomb rack may be jettisoned when the following conditions exist:

a. (WSO) Emergency landing gear handle in or armament safety override button pushed in.
b. Weight off the gear or landing gear handle in the up position.

To jettison the centerline suspension equipment or store, perform the following:

1. Center station jettison switch - JETT.

M118 and MK84 Jettison

The TK (tank aboard) light may provide an indication of which jettison circuit is required to jettison the M118 or MK 84 GP bomb from the CL bomb rack. If the TK light is ON, the non-nuclear jettison circuit can be used (the panic button or the centerline station jettison switch); the forward fuselage AIM-7 missiles cannot be launched.

If the TK light is OFF with the M118 or MK 84 bomb aboard, the centerline nuclear store jettison circuit may be required to jettison the M118 or MK 84 bomb.

LEFT OR RIGHT INBOARD STATION JETTISON

The controls on the missile status panel are used to jettison the left or right inboard station. With an AGM-45A or AGM-12/B aboard, the missile is jettisoned without motor ignition; the launcher remains aboard. The TER or single suspended weapons are jettisoned. The rocket motor is ignited to jettison heat missiles and the TDU-11/B target rocket. All launchers remain aboard. The following conditions must exist to jettison from the armament pylon:

a. Inflight lockout pins installed, DCU-94/A LI and RI UNLOCKED lights on.
b. Wing flap switch must be in the full UP position to jettison the heat missiles or the target rocket.
c. For bombs suspended directly from the armament pylons, the master arm switch must be in SAFE if bombs are to be jettisoned in a safe condition.

To jettison from the left or right inboard stations, perform the following:

1. Master arm switch - SAFE (if applicable)
2. Missile jettison selector knob - L WING or R WING
3. Missile jettison selector knob - PUSH

Note

The missile jettison selector knob is hot when EXT or GEN power is applied to the aircraft.

OUTBOARD STATIONS JETTISON
(Before T.O. 1F-4-863)

The outboard station jettison switch receives power as soon as EXT or GEN power is available. The JETT position of the control jettisons the equipment suspended on both outboard stations. Munitions suspended from the LAU-34 launcher are jettisoned with the launcher retained.

When bombs are suspended directly from the armament pylon, the master arm switch or the arm/nose tail switch must be in SAFE to preclude bomb arming.

OUTBOARD STATION JETTISON
(After T.O. 1F-4-863)

The outboard pylon jettison select switch (figure 3-1) provides a selective jettison function for the outboard wing stations. The switch is positioned to either LEFT, RIGHT, or BOTH, and then the wing station jettison switch is energized to jettison the contents of the outboard station(s). The selective LEFT and RIGHT positions enable the AC to meet specific jettison requirements if an unsymmetrical external store load exists on the outboard stations.

Note

The outboard jettison selector is actually a five-position switch and the UP and INBD (unmarked) locations on the switch are OFF positions. The (OFF) positions disable the wing station jettison switch.

To jettison from the outboard stations perform the following:

1. Outboard jettison selector (if available) - LEFT, RIGHT, or BOTH
2. Wing station jettison switch - JETT

FUSELAGE MISSILE JETTISON

The controls on the missile status panel are used to jettison the AIM-7 missiles from the forward and rear fuselage stations (stations 3, 4, 6, and 7). The missiles are selectively jettisoned without motor ignition. When the TK light is ON, the two forward missiles cannot be launched or jettisoned. The missile jettison selector knob is hot with EXT or GEN power applied to the aircraft.

1. Select the required fuselage station.
2. Missile jettison knob - PUSH

ECM POD JETTISON

ECM pod equipment carried on wing and CL stations would normally be jettisoned individually or collectively by using the controls described in the preceding paragraphs. However, T.O. 1F-4C-35 states that ejector rack cartridges will not be installed in pylons with ECM equipment aboard. Fuselage mounted pods cannot be jettisoned in any case; a fuselage station jettison system does not exist when pods are aboard.

NUCLEAR JETTISON AND RELEASE CIRCUITS

The nuclear jettison and release circuits are functional through the DCU-94/A control-monitor panel to jettison suspension equipment or weapons carried by the wing station armament pylons (except the RO) and the centerline station. With inflight lockout pins installed in the wing armament pylons, the LO, RO, LI and RI UNLOCKED lights on the DCU-94/A control-monitor illuminate when power is applied to the aircraft. If the nuclear jettison control is used to jettison conventional stores, then the contents of all nuclear stations (LO, LI, CL, RI) can be jettisoned simultaneously or individually by selecting one or more stations. If the nuclear release controls are used, stations can only be jettisoned individually.

JETTISON THRU NUCLEAR RELEASE CIRCUIT

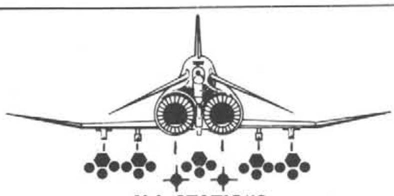
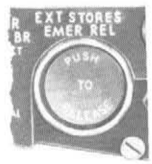
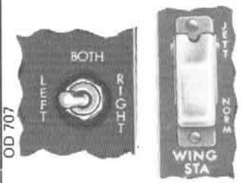
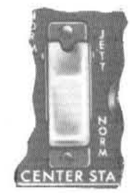
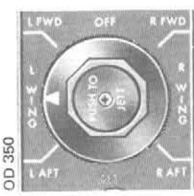
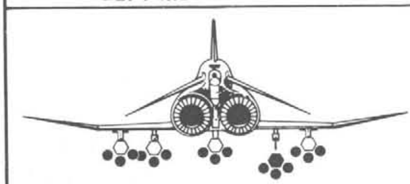
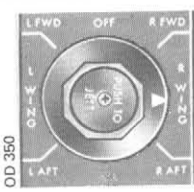
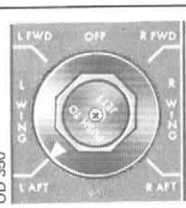
The DIRECT bombing mode and nuclear release controls may be used as an alternate method of jettisoning the suspension equipment. However, the RO MER cannot be released with the nuclear release circuit and the LO MER can not be released when the MER is shifted aft. The following procedures also apply to bombs suspended directly from the armament pylons or the centerline bomb rack.

Note

The inflight lockout pins may be IN or OUT.

1. Master arm switch - SAFE
   With the master arm switch in SAFE, the arm nose tail switch is inoperative. If single suspended bombs are to be released ARMED, place the master arm switch to ARM and the arm nose tail switch to NOSE or NOSE & TAIL.

JETTISON CHART F-4C

STATION JETTISON	SWITCH		SWITCH POSITION	LOCATION
 ALL STATIONS	OD 707 	[1] [2] EXTERNAL STORES EMER RELEASE (PANIC BUTTON)	PUSH	LEFT SUB PANEL
 OUTBOARD STATIONS	OD 707 	[3] OUTBD JETT. SELECT [4] WING STA JETTISON SWITCH	1. SELECT LEFT RIGHT, OR BOTH 2. POSITION UP TO JETT	LEFT/REAR CONSOLE FUEL CONTROL PANEL
 CENTERLINE STATION	OD 707 	[1] CENTER STA JETTISON SWITCH	POSITION UP TO JETT	FUEL CONTROL PANEL
 LEFT INBOARD STATION	OD 350 	[2] [4] MISSILE JETTISON KNOB	1. L WING POSITION – 2. PUSH TO JETT	MISSILE STATUS PANEL
 RIGHT INBOARD STATION	OD 350 	[2] [4] MISSILE JETTISON KNOB	1. R WING POSITION – 2. PUSH TO JETT	MISSILE STATUS PANEL
 FUSELAGE/MISSILES	OD 350 	[4] [5] MISSILE JETTISON KNOB	1. SELECT FUS. STATION 2. PUSH TO JETT (REPEAT FOR REMAINING FUS. STATIONS)	MISSILE STATUS PANEL

Notes

- See T.O. 1F-4C-1 for jettison limits.
- Pylon inflight lockout pins must be installed.
- Fuselage ECM pods are non-jettisonable; cartridges are not installed in wing/CL stations with ECM pods aboard.

[1] Emer gear handle IN with weight off gear or gear handle UP; or arm safety override button IN.

[2] Wing flap sw must be UP to jettison AIM-9 or TDU-11/B.

[3] After T.O. 1F-4-863; the OFF position disables the wing sta jett sw.

[4] Control is HOT with EXT or GEN power ON.

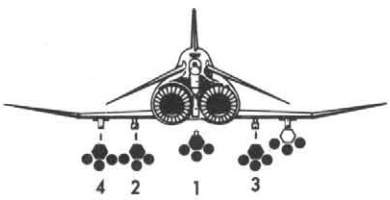
[5] Station 4 and 6 RDR missiles cannot jettison with fuel tank, MER, or gun pod aboard CL station.

4C-34-1-1-(152-1)

Figure 3-1 (Sheet 1 of 2)

JETTISON CHART F-4C (CONTINUED)

DCU–94/A RELEASE

STATION JETTISON	SWITCH		SWITCH POSITION
RELEASE		BOMB MODE SELECTOR KNOB	DIRECT
		APPLICABLE STATION SELECTOR SWITCH	FORWARD
		MASTER RELEASE LOCK SWITCH	FORWARD
		NUCLEAR STORE CONSENT SWITCH	REL OR REL/ARM
		BOMB RELEASE BUTTON	DEPRESS
		SELECTED STATION SELECTOR SWITCH. (Repeat above procedures for each station.)	AFT

Notes

1. The inflight lockout pins may or may not be installed.
2. RO station cannot be jettisoned thru DCU–94/A.
3. AIM–9B, AGM–12B and AGM–45 missiles cannot be jettisoned with the nuclear release circuit.

4C–34–1–1–(152-2)

Figure 3-1 (Sheet 2 of 2)

2. Bomb mode selector knob - DIRECT
   The DIRECT mode provides an immediate release when the bomb button is depressed.
3. DCU-94/A station selector switch - FORWARD (DESIRED STATION)
4. DCU-94/A master release lock switch - FORWARD
   a. DCU-94/A wing station UNLOCKED light (if selected) - ON

Note

If the inflight lockout pins are not installed, the wing station UNLOCKED light illuminates after step 4. If the inflight lockout pins are installed, these lights illuminate continuously.

5. (P) Nuclear store consent switch - REL or REL/ARM
   a. DCU-94/A CL UNLOCKED light (if the CL station is selected) - ON
6. Bomb button - DEPRESS
   The suspension equipment or the single suspended bomb on the selected station is released when the bomb button is depressed.
7. For remaining station(s), place the station selector AFT and repeat steps 3 and 6.

Jettison with Nuclear Jettison Circuit

CAUTION

The nuclear store jettison circuit should not be used for selective jettison from a particular station. The nuclear store jettison button (NUCLEAR PUSH TO JETT) should be used as a last resort, and only when the inadvertent jettison from unselected stations is of little concern. For example, the fuselage missiles may be jettisoned and both inboard stations may be jettisoned even though only the right or left inboard station is selected on the DCU-94/A. Both outboard stations may be jettisoned even though only the left outboard station is selected on the DCU-94/A. When only the centerline station is selected, only the centerline station is jettisoned. When only the RO station is selected, the nuclear jettison circuit is inoperative.

The following procedures apply for bombs and MER/TER's that are suspended directly from the armament pylon or the BRU-5/A centerline bomb rack:

Note

The inflight lockout pins may be IN or OUT.

1. Master arm switch - SAFE (if applicable)
   With the master arm switch in SAFE, the arm nose tail switch is inoperative. If single suspended bombs are to be released ARMED, place the master arm switch to ARM and the arm nose tail switch to NOSE or NOSE & TAIL.
2. DCU-94/A station selector switches (loaded stations) - FORWARD
3. DCU-94/A master release lock switch - FORWARD
   a. DCU-94/A wing station UNLOCKED lights (if selected) - ON
      If the inflight lockout pins are not installed, the wing station UNLOCKED lights illuminate after step 3. If the flight lockout pins are installed, these lights illuminate continuously with power on the aircraft.
4. (P) Nuclear store consent switch - REL or REL/ARM
   a. DCU-94/A CL UNLOCKED light, if the CL station is selected - ON
5. Nuclear store jettison switch - JETT
   The selected stations jettison simultaneously.

PART 2 EMERGENCY AIRCREW PROCEDURES F-4D

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EMERGENCY RELEASE PROCEDURES (F-4D)

Emergency Release is the term used when the normal bomb release system is employed; e.g., to release empty launchers or to expediently release weapons with the ripple release mode. All nonnuclear, air-to-ground weapons (with the exception of the gun pods and AGM missiles) will be released through the normal, non-nuclear weapons release mode. The suspension equipment should be retained during emergency conditions. Refer to jettison procedures when TIME is the overriding factor.

HUNG ORDNANCE

Hung ordnance is the term used when an unsuccessful attempt has been made to release or jettison a weapon from the aircraft.

WARNING

Following an attempted release or jettison, any nonnuclear weapon that does not separate from the aircraft should be considered armed and susceptible to inadvertent release during landing. Under these circumstances, the aircrew should be prepared to make an immediate go-around in the event an inadvertent release of a hung store occurs during landing.

EMERGENCY BOMB, LAUNCHER, DISPENSER RELEASE

When an unsuccessful attempt has been made to release the weapon(s) from the MER or TER, recheck switch positions and repeat original release procedure. If weapon(s) does not release, perform the following:

1. Home MER/TER bomb racks.
   a. Weapons selector knob - RKTS & DISP
      The above step is not required for launcher and dispenser release.
2. Weapons selector knob - BOMB/RIPPLE.
3. Arm nose-tail switch - SET AS REQUIRED
   The SAFE position is normally used.
4. Bomb button - DEPRESS (hold 4 seconds)
5. Repeat the above procedure if all bombs do not release.
6. If the weapon should not be returned to base, refer to jettison procedures.

JETTISON PROCEDURES(F-4D)

WARNING

Refer to T.O. 1F-4C-1 (Unclassified) for carriage and jettison restrictions on the aircraft. Classified limitations are provided in T.O. 1F-4C-34-1-1A.

The term jettison implies the use of the jettison controls or the normal release controls to clean the aircraft of suspension equipment, to launch missiles unguided, or to release the missiles without motor ignition.

EMERGENCY JETTISON, MULTI-STATION

EXTERNAL STORE EMER RELEASE BUTTON

The external store emergency release button (panic button) is the most expedient means to clean the wing CL, and fuselage stations. The MAU-12 armament pylons cannot be jettisoned. However, the MER's and TER's, gun pods, AGM missiles (less the launcher), and weapons suspended directly from the pylons are jettisoned. With the centerline tank aboard (TK) light ON, a MK 84 or M118 GP bomb, the centerline MER, fuel tank, or gun pod is jettisoned from the BRU-5A bomb rack. AIM-9 and AIM-4D missiles cannot be jettisoned. (See figure 3-2). Radar missiles are jettisoned.

WARNING

The AIM-9 missile should be considered armed and to have some guidance capability.

The following conditions must exist:

a. Inflight lockout pins installed in the MAU-12 armament pylons. DCU-94/A LO, LI, and RI UNLOCKED lights illuminate.
b. (WSO) Emergency landing gear handle in or armament safety override button pushed in.
c. Weight off the gear or landing handle in the up position, or the armament safety override button pushed in.
d. TK light on for the centerline station.
e. Wing flaps must be up for wing station AIM-9 missiles.
f. For bombs suspended directly from the armament pylons or the BRU-5A bomb rack, the master arm switch or the arm nose tail switch must be in SAFE if the bombs are to be jettisoned in the safe condition.

To jettison all external equipment, perform the following:

1. Master arm switch - SAFE (if applicable)
2. External stores emergency release button (panic button) - PUSH

SELECTIVE JETTISON

CENTERLINE STATION JETTISON

When the TK light is ON the tank aboard relay is energized, the equipment or weapon suspended from the BRU-5/A bomb rack is jettisoned when the following conditions exist:

a. (WSO) Emergency landing gear handle in or armament safety override button pushed in.
b. Weight off the gear or landing gear handle in the up position.

To jettison the centerline suspension equipment or store, perform the following:

1. Center station jettison switch - JETT.

Note

F-4D-28 and up, the TK light is OFF when the gun pod is loaded on the CL station. However, the gun pod can still be jettisoned with the center station jettison switch.

M118 AND MK 84 JETTISON

The TK (tank aboard) light may provide an indication of which jettison circuit is required to jettison the M118 or MK 84 GP bomb from the BRU-5A bomb rack. If the TK light is ON, the non-nuclear jettison circuit can be used (the panic button or the centerline station jettison switch): the forward fuselage radar missile cannot be launched.

If the TK is OFF with the M118 or MK 84 bomb aboard, the nuclear store jettison circuit may be required to jettison the M118 or MK 84 bomb. On F-4D-28 and up, the tank aboard relay is bypassed (TK light is OFF) when the gun pod is aboard; therefore, the two forward AIM-7 missiles can be launched.

LEFT OR RIGHT INBOARD STATION JETTISON

The controls on the missile status panel are used to jettison the left or right inboard station. The armament pylon inflight lockout pins must be installed. The TER or single suspended weapons are jettisoned. The rocket motor is ignited to jettison the heat missiles and the TDU-11/B target rocket. The heat missiles are not armed and have no hydraulic power for guidance. The AGM-45 and AGM-12B/C missiles are jettisoned without motor ignition and the LAU-34/A launcher remains with the pylon. The following conditions must exist to jettison from the inboard armament pylon:

a. Inflight lockout pins installed, DCU-94/A LI and RI Unlocked lights on.
b. The emergency landing gear handle must be IN and the weight off the gear, or landing gear handle UP, or armament safety override button IN.
c. To jettison the AIM-4D and AIM-9 missiles, the wing flaps and the landing gear must be up. For the AIM-4D, the left main gear door must be closed. For the AIM-9, weight must be off the left main gear.
d. For bombs suspended directly from the armament pylons, the master arm switch must be in SAFE if the bombs are to be jettisoned in a safe condition.

To jettison from the left or right inboard stations, perform the following:

1. Master arm switch - SAFE (if applicable)
2. Missile jettison selector knob - L WING or R WING
3. Missile jettison selector knob - PUSH

OUTBOARD STATIONS JETTISON (Before T.O. 1F-4-863)

The outboard station jettison switch receives power as soon as EXT or GEN power is available. The JETT position of the control jettisons the equipment suspended on both outboard stations. Munitions suspended from the LAU-34 launcher are jettisoned with the launcher retained. When bombs are suspended directly from the armament pylon, the master arm switch or the arm/nose tail switch must be in SAFE to preclude bomb arming. The AGM-12B is jettisoned without motor ignition; the launcher remains aboard.

OUTBOARD STATIONS JETTISON (After T.O. 1F-4-863)

The outboard pylon jettison select switch (figure 3-2) provides a selective jettison function for the outboard wing stations. The switch is positioned to either LEFT, RIGHT, or BOTH, and then the wing station jettison switch is energized to jettison the contents of the outboard station(s). The selective LEFT and RIGHT positions enable the AC to meet specific jettison requirements if an unsymmetrical external store load exists on the outboard stations.

Note

The outboard jettison selector is actually a five-position switch and the UP and INBD (unmarked) locations on the switch are OFF positions. These positions disable the wing station jettison switch.

To jettison munitions from the outboard stations perform the following:

1. Outboard jettison selector (if available) - LEFT, RIGHT, or BOTH.
2. Wing station jettison switch - JETT

FUSELAGE MISSILE JETTISON

The controls on the missile status panel are used to jettison the AIM-7 missiles from the forward and rear fuselage stations (stations 3, 4, 6, and 7). The missiles are selectively jettisoned without motor ignition. When the TK light is ON, the two forward missiles cannot be launched or jettisoned. The emergency landing gear handle must be IN and the weight off the gear, or landing gear handle UP, or armament safety override button IN. To jettison a radar missile, perform the following:

1. Select the required fuselage station.
2. Missile jettison selector - PUSH

ECM POD JETTISON

ECM pod equipment carried on wing and CL stations would normally be jettisoned individually or collectively by using the controls described in the preceding paragraphs. However, T.O. 1F-4C-35 states that ejector rack cartridges will not be installed in pylons with ECM equipment aboard. Fuselage mounted pods cannot be jettisoned in any case; a fuselage station jettison system does not exist when pods are aboard.

ECM Jettison Switch

The ECM jettison switch on the left console is functional only if an ECM pod is aboard the RO station (9) and only if RO rack cartridges are installed. This control will not jettison a station 9 munition or fuel tank.

NUCLEAR JETTISON AND RELEASE CIRCUITS

The nuclear jettison and release circuits are functional through the DCU-94/A control-monitor panel to jettison suspension equipment or weapons that are carried by the armament pylons (except the RO) and the centerline bomb rack. When the inflight lockout pin is installed in the wing armament pylons, the LO, LI and RI UNLOCKED lights on the DCU-94/A control-monitor illuminate with EXT or GEN power applied to the aircraft.

If the nuclear jettison control is used to jettison conventional stores, then the contents of all nuclear stations (LO, LI, CL, RI) can be jettisoned simultaneously or individually by selecting one or more stations. If the nuclear release controls are used, stations can only be jettisoned individually.

Jettison Thru Nuclear Release Circuit

The DIRECT bombing mode and nuclear release controls may be used as an alternate method of jettisoning the suspension equipment. However, the RO MER cannot be bombed off with the nuclear release circuit and the LO MER cannot be bombed off when the MER is shifted aft. The following procedures also apply for bombs that are suspended directly from the armament pylons or the centerline bomb rack.

Note

The inflight lockout pins may be IN or OUT.

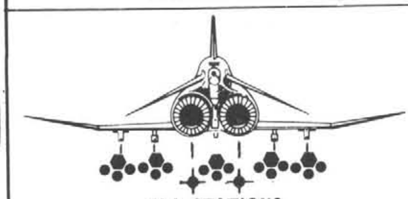
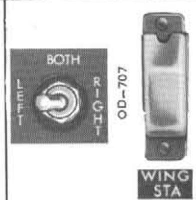
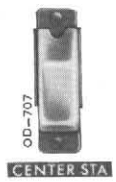
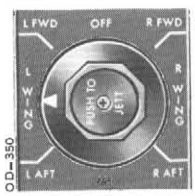
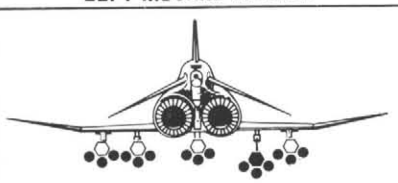
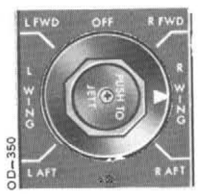
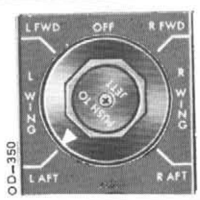
1. Master arm switch - SAFE
   With the master arm switch in SAFE, the arm nose tail switch is inoperative. The master arm switch is used only with single bomb suspension. If the bombs are to be released ARMED, place the master arm switch to ARM and the arm nose tail switch to NOSE or NOSE & TAIL.
2. Bomb mode selector knob - DIRECT
   The DIRECT mode is used to provide an immediate release when the bomb button is depressed.
3. DCU-94/A station selector switch - FORWARD (DESIRED STATION)
4. DCU-94/A master release lock switch - FORWARD
   a. DCU-94/A wing station UNLOCKED light (if selected) - ON

Note

If the inflight lockout pins are not installed, the wing station UNLOCKED light illuminates after step 4. If the inflight lockout pins are installed, these lights illuminate continuously.

5. (WSO) Nuclear store consent switch - REL or REL/ARM
   a. DCU-94/A CL UNLOCKED light (if the CL station is selected) - ON
6. Bomb button - DEPRESS
   The suspension equipment or the single suspended bomb on the selected station is released when the bomb button is depressed.
7. For remaining station(s), place the station selector AFT and repeat steps 3 and 6.

JETTISON CHART F-4D

STATION JETTISON	SWITCH		SWITCH POSITION	LOCATION
 ALL STATIONS		1 2 EXTERNAL STORES EMER RELEASE (PANIC BUTTON)	PUSH	LEFT SUB PANEL
 OUTBOARD STATIONS		3 OUTBD JETT SELECT 4 WING STA JETTISON SWITCH	1. SELECT LEFT, RIGHT OR BOTH 2. POSITION UP TO JETT	LEFT/REAR CONSOLE FUEL CONTROL PANEL
 CENTERLINE STATION		1 CENTER STA JETTISON SWITCH	POSITION UP TO JETT	FUEL CONTROL PANEL
 LEFT INBOARD STATION		1 MISSILE JETTISON KNOB 5	1. L WING POSITION 2. PUSH CENTER BUTTON	MISSILE STATUS PANEL
 RIGHT INBOARD STATION		1 MISSILE JETTISON KNOB 5	1. R WING POSITION 2. PUSH CENTER BUTTON	MISSILE STATUS PANEL
 FUSELAGE MISSILES		MISSILE 1 6 JETTISON KNOB	1. SELECT FUS STATION 2. PUSH CENTER BUTTON	MISSILE STATUS PANEL

Notes

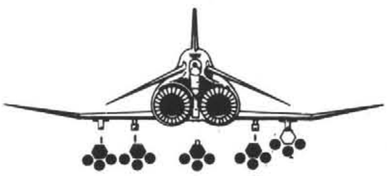
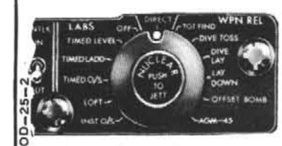
- See T.O. 1F-4C-1 for jettison limits.
- Pylon inflight lockout pins must be installed.
- Fuselage ECM pods are non-Jettisonable; cartridges are not installed in wing/CL stations with ECM pods aboard.

1. Emer gear handle IN with weight off gear or gear handle UP; or armament safety override button IN.
2. Heat missiles do not jettison
3. After T.O. 1F-4-863, the OFF position disables the wing sta jett sw.
4. Switch is HOT with EXT. or GEN. power ON.
5. Wing flaps must be UP to jettison heat missiles; gear UP for AIM-4D.
6. Station 4 and 6 RDR missiles cannot jettison with fuel tank, MER, or gun pod aboard CL station. (Block 28 and up, CL gun pod will not inhibit station 4 and 6 jettison.)

4C-34-1-1-(153-2)

Figure 3-2 (Sheet 1 of 2)

JETTISON CHART | F-4D | (CONTINUED) DCU-94/A RELEASE

STATION JETTISON	SWITCH		SWITCH POSITION
RELEASE 		DELIVERY MODE SELECTOR KNOB	DIRECT
		APPLICABLE STATION SELECTOR SWITCH	FORWARD
		MASTER RELEASE LOCK SWITCH	FORWARD
		NUCLEAR STORE CONSENT SWITCH	REL OR REL/ARM
		BOMB RELEASE BUTTON	DEPRESS
		SELECTED STATION SELECTOR SWITCH. (Repeat above procedures for each station.)	AFT

Notes

1. The inflight lockout pins may or may not be installed.
2. RO station cannot be jettisoned thru DCU-94/A.
3. AGM-12B, AGM-45 and heat missiles can not be jettisoned.

4C-34-1-1-(153-3)

Figure 3-2 (Sheet 2 of 2)

Jettison with the Nuclear Jettison Circuit

CAUTION

The nuclear store jettison circuit should not be used for selective jettison from a particular station. The nuclear store jettison button (NUCLEAR PUSH TO JETT) should be used only after all other jettison methods have failed or can not be used, and only when the inadvertent jettison from unselected stations is of little concern. For example; the fuselage missiles may be jettisoned and both inboard stations will be jettisoned even though only the right or left inboard station is selected on the DCU-94/A. Both outboard stations may be jettisoned even though only the left outboard station is selected on the DCU-94/A. When only the centerline station is selected, only the centerline station will be jettisoned. When only the RO station is selected, the nuclear jettison circuit is inoperative.

The following procedures apply for bombs and MER/TER's suspended directly from the armament pylon or the centerline bomb rack:

Note

The inflight lockout pins may be IN or OUT.

1. Master arm switch - SAFE (if applicable)
   With the master arm switch in SAFE, the arm nose tail switch is inoperative. The master arm switch is used only with single bomb suspension. If the bombs are to be released ARMED, place the master arm switch to ARM and the arm nose tail switch to NOSE or NOSE & TAIL. The AIM-4D missile and the launchers cannot be jettisoned with the nuclear jettison circuit.
2. DCU-94/A station selector switches (loaded stations) - FORWARD
3. DCU-94/A master release lock switch - FORWARD
   a. DCU-94/A wing station UNLOCKED lights (if selected) - ON
      If the inflight lockout pins are not installed, the wing station UNLOCKED lights illuminate after step 3. If the flight lockout pins are installed, these lights illuminate while power is on the aircraft.
4. (P) Nuclear store consent switch - REL or REL/ARM
   a. DCU-94/A CL UNLOCKED light, if the CL station is selected - ON
5. Nuclear store jettison button - PUSH

PART 3 EMERGENCY AIRCREW PROCEDURES F-4E

TABLE OF CONTENTS

EMERGENCY RELEASE AND JETTISON PROCEDURES (F-4E) BEFORE T.O. 1F-4E-556

Emergency Release is the term used when the normal bomb release system is employed; e.g. to release empty launchers or to expediently release weapons with the ripple release mode. All nonnuclear, air-to-ground weapons (with the exception of the gun pods and AGM missiles) may be released through the normal, nonnuclear weapons release mode. The suspension equipment should be retained during emergency conditions. Refer to jettison procedures when TIME is the overriding factor.

HUNG ORDNANCE

Hung ordnance is the term used when an unsuccessful attempt has been made to release or jettison a weapon from the aircraft.

WARNING

Following an attempted release or jettison, any non-nuclear weapon that does not separate from the aircraft should be considered armed and susceptible to inadvertent release during landing. Under these circumstances, the aircrew should be prepared to make an immediate go-around in the event an inadvertent release of a hung store occurs during landing.

EMERGENCY RELEASE (BOMBS, LAUNCHERS & DISPENSERS)

When an unsuccessful attempt has been made to release the weapon(s) from the MER or TER, recheck switch positions and repeat original release procedure. If weapon(s) does not release, perform the following:

1. Home MER/TER bomb racks.
   a. Weapons selector knob - RKTS & DISP
      The above step is not required for launcher and dispenser release.
2. Weapons selector knob - BOMB/RIPPLE.
3. Arm nose tail switch - SET AS REQUIRED
   The SAFE position is normally used.
4. Bomb button - DEPRESS (hold 4 seconds)
5. Repeat the above procedure if all bombs do not release.
6. If the weapon should not be returned to base, refer to jettison procedures.

WARNING

Refer to T.O. 1F-4C-1 (Unclassifed) for flight and jettison restrictions.

The term jettison implies the use of the jettison controls or the normal release controls to clean the aircraft of suspension equipment, to launch missiles unguided, or to release the missiles without motor ignition.

EMERGENCY JETTISON, MULTI-STATION

EXTERNAL STORE EMER RELEASE BUTTON

The external store emergency release button (panic button) is the most expedient means to clean the aircraft. The MAU-12 armament pylons cannot be jettisoned. However, the MER's and TER's, gun pods, AGM missiles (less the launcher), and weapons suspended directly from the pylons are jettisoned through this control. The heat and radar missiles are not jettisoned.

The following conditions must exist:

a. Inflight lockout pins installed in the MAU-12 armament pylons. DCU-94/A LO, LI, and RI UNLOCKED lights illuminate.
b. (WSO) Emergency landing gear handle in or armament safety override button pushed in.
c. Weight off the gear or landing handle in the up position, or the armament safety override button pushed in.
d. TK light on for the centerline station.
e. For bombs suspended directly from the armament pylons or the BRU-5A bomb rack, the master arm switch or the arm nose tail switch must be in SAFE if the bombs are to be jettisoned in the safe condition.

To jettison wing and CL station external equipment, perform the following:

1. Master arm switch - SAFE (if applicable)
2. External stores emergency release button (panic button) - PUSH

SELECTIVE JETTISON

CENTERLINE STATION JETTISON

a. (WSO) Emergency landing gear handle in or armament safety override button pushed in.
b. Weight off the gear or landing gear handle in the up position.
c. TK light - ON.

To jettison the centerline suspension equipment or store, perform the following:

1. Center station jettison switch - JETT.

Note

The TK light is OFF when the gun pod is loaded on the CL station. However, the gun pod can still be jettisoned with the center station jettison switch.

M118 and MK 84 Jettison

The TK (tank aboard) light may provide an indication of which jettison circuit is required to jettison the M118 or MK 84 GP bomb from the BRU-5A bomb rack. If the TK light is ON, the conventional weapons jettison circuit can be used (the panic button or the centerline station jettison switch); the forward fuselage AIM-7 missiles cannot be launched.

If the TK is OFF with the M118 or MK 84 bomb aboard, the nuclear store jettison circuit may be required to jettison the M118 or MK 84 bomb. The tank aboard relay is bypassed (TK light is OFF) when the gun pod is aboard; therefore, the two forward AIM-7 missiles can be launched with the gun pod aboard and then the bomb and the gun pod can be jettisoned with the non-nuclear jettison circuit.

LEFT OR RIGHT INBOARD STATION JETTISON

The controls on the missile status panel are used to jettison the left or right inboard station. Position the missile jettison selector knob to L WING or to R WING and then push the missile jettison knob.

The inflight lockout pin must be installed in the MAU-12 armament pylons. The pylons cannot be jettisoned. The TER's or single suspended weapons will be jettisoned. The rocket motor must be ignited to jettison the heat missiles. The AIM-4D and AIM-9 are not armed and will not have hydraulic power for guidance. The AGM-45 and AGM-12B/C missiles are jettisoned without motor ignition and the LAU-34/A launcher remains on the pylon. The following conditions must exist to jettison from the MAU-12 armament pylon:

a. Inflight lockout pins installed, DCU-94/A LI and RI UNLOCKED lights on.
b. Wing flaps must be up to jettison heat missiles.
c. The emergency landing gear handle must be in and weight off the landing gear, or landing gear handle up; or armament safety override button in. For the AIM-4D, the left main gear door must be closed. For the AIM-9, the weight must be off the left main gear.
d. For bombs suspended directly from the armament pylons, the master arm switch or the arm nose tail switch must be in SAFE if the bombs are to be jettisoned safe.

To jettison from the left or right inboard stations, perform the following:

1. Master arm switch - SAFE (if applicable)
2. Missile jettison selector knob - L WING or R WING
3. Missile jettison selector knob - PUSH

OUTBOARD STATIONS JETTISON

Both outboard wing stations are jettisoned when the wing station jettison switch is placed to JETT; the switch is "hot" when power is applied to the aircraft. The inflight lockout pins must be installed. The RO UNLOCKED light will not be illuminated. When bombs are suspended directly from the armament pylon, the master arm switch must be in SAFE to preclude bomb arming. The AGM-12B is jettisoned without motor ignition; the launcher remains aboard.

To jettison from the outboard stations, perform the following:

1. Master arm switch - SAFE (if applicable)
2. Wing station jettison switch - JETT

FUSELAGE MISSILE JETTISON

The controls on the missile status panel are used to jettison the AIM-7 missiles from the forward and aft fuselage stations (stations 3, 4, 6, and 7). The missiles will be jettisoned without motor ignition. Note the following conditions:

a. When the TK lights is ON, the two forward missiles cannot be launched or jettisoned. Refer to BRU 5A bomb rack, section I.
b. The emergency landing gear handle must be IN with weight off the gear, or landing gear handle UP, or armament safety override button in.
c. Missile jettison selector button - PUSH

ECM POD JETTISON

ECM pod equipment carried on wing and CL stations would normally be jettisoned individually or collectively by using the controls described in the preceding paragraphs. However, T.O. 1F-4C-35 states that ejector rack cartridges will not be installed in pylons with ECM equipment aboard. Fuselage mounted pods cannot be jettisoned in any case; a fuselage station jettison system does not exist when pods are aboard.

ECM Jettison Switch

The ECM jettison switch on the left console is functional only if an ECM pod is aboard the RO station (9) and only if RO rack cartridges are installed. This control will not jettison a station 9 munition or fuel tank.

EMERGENCY RELEASE AND JETTISON PROCEDURES (F-4E) AFTER T.O. 1F-4E-556

This part of emergency release and jettison data is presented essentially in the form of difference data. Therefore terms such as hung ordnance, or the release interlocks such as the landing gear handle are not redefined since they are the same as described in the preceding pages.

EMERGENCY RELEASE (BOMBS, LAUNCHERS & DISPENSERS)

These procedures consider the emergency release of bombs, dispensers, or rocket launchers using the normal release controls (figure 3-3, sheet 2). The procedure may be used when weapons are to be emergency-released without the loss of carriage equipment (MERS or TERS). The weapon select BOMBS position is used, and the arm nose tail switch must be out of the SAFE position to get the indications of the station ARM light. It is assumed that release systems controls are already energized; the AC has the DIRECT mode, master arm, and the desired stations selected.

1. Weapon selector knob - BOMBS
   Select BOMBS if RKTS & DISP were previously selected.
2. ARM nose tail switch - OUT OF SAFE
   With BOMBS selected, the arm nose tail switch must be in an (ON) position to obtain the station ARM light ON.
3. AWRU Qty knob - C or S
   The C or S positions provide the most rapid release method.

CAUTION

When selecting either C or S, observe minimum release interval between bombs released from the same aircraft station.

4. Bomb button - DEPRESS
   a. Hold bomb button signal until station ARM lights go off.

If all munitions do not release:

5. Weapon selector knob - RKTS & DISP
6. Weapon selector knob - BOMBS
7. Bomb button - DEPRESS
   a. Station ARM lights - OFF

If munitions do not release, refer to jettison procedures.

EMERGENCY JETTISON, MULTI-STATION

EXTERNAL STORES EMERGENCY RELEASE BUTTON

The external stores emergency release button may be used to jettison simultaneously the contents of stations 1, 2, 5, 8 and 9. Stations 2 and 8 are not jettisoned if AIM-4 or AIM-9 munitions are aboard, and fuselage missile stations are not jettisoned. The munitions, including MER/TER carriage equipment are jettisoned directly from the armament pylon (figure 3-3 sheet 2). If the LAU-34 launcher is aboard (AGM-45, AGM-12B) the launcher is retained.

EMERGENCY JETTISON, SELECTIVE STATIONS

The selective jettison control on the main instrument panel may be used to jettison the contents of any conventional store station on the aircraft. This includes any wing and CL station stores, inboard wing station heat missile, and fuselage station radar missiles.

HEAT MISSILES (STATIONS 2 AND 8)

Heat missile stations 2 and 8 are selected individually by positions L WING or R WING, and both missiles aboard that station are jettisoned by depressing the PUSH TO JETT control. The missiles are launched ballistically (motor ignited) in an inert state.

AGM-65/A MISSILES (STATIONS 2 AND 8)(71-237 and up)

The AGM-65/A (Maverick) missiles are individually jettisoned by using the same switching procedures as those used for heat missiles. The difference is that a single missile is jettison-launched when the JETT button is depressed. The entire load (missiles plus LAU-88/A launcher) is jettisoned by following the procedures for Wing and CL Stations (below).

RADAR MISSILES (STATIONS 3, 4, 6, AND 7)

Fuselage station radar missiles are jettisoned individually by selecting either L FWD, R FWD, L AFT, or R AFT, and depressing PUSH TO JETT. A single radar missile is ejected and freefalls without motor ignition.

WING AND CL STORES (STATIONS 1, 2, 5, 8 AND 9)

The AC selects the STORES position on the jettison knob and depresses the required station select button(s) for the station(s) to be jettisoned. The corresponding stores are jettisoned by depressing the PUSH TO JETT button. If heat missiles are aboard, stations 2 and 8 do not jettison.

NUCLEAR JETTISON AND RELEASE CIRCUITS (ALL AIRCRAFT)

The nuclear circuits are functional through the DCU-94/A control-monitor panel to jettison suspension

equipment or weapons carried by the MAU-12 armament pylons (except the RO) and the centerline BRU-5A bomb rack. When the inflight lockout pin is installed in the wing armament pylons the LO, LI and RI UNLOCKED lights on the DCU-94/A control-monitor illuminate when power is applied to the aircraft. The RO light will not illuminate even though the pin may be installed.

CAUTION

Nuclear jettison controls are considered here only as a backup method if all other methods have failed or cannot be used, i.e., inflight lockout pins not installed. With conventional weapons aboard, nuclear jettison procedures may not yield the desired results.

When the inflight lockout pins are installed, the non-nuclear jettison circuit can be used to jettison the MER's and TER's from the armament pylons. If the inflight lockout pins are not installed, only the nuclear store circuit can be used to jettison the LO, LI and RI stations; the RO station cannot be jettisoned. When the nuclear circuits are used, the UNLOCKED lights illuminate after the DCU-94/A master release lock switch is positioned forward and the DCU-94/A stations are selected, regardless of the nuclear store consent switch; however, the nuclear store consent switch must be in REL or REL/ARM before the LO MER or TER's can be jettisoned. The DCU-94/A CL UNLOCKED lights will not illuminate until all three switches are energized.

a. DCU-94/A CL station selector - FORWARD
b. DCU-94/A Master release lock switch - FORWARD
c. Nuclear store consent switch - REL or REL/ARM

JETTISON WITH THE NUCLEAR RELEASE CIRCUIT

The bomb release button, the DCU-94/A control-monitor, the DIRECT bombing mode, and nuclear store consent switch may be used as an alternate method of jettisoning the suspension equipment. However, the LO MER when shifted aft and the RO MER cannot be bombed off with nuclear release circuit. The following procedures also apply for bombs that are suspended directly from the armament pylons or the centerline bomb rack.

Note

Inflight lockout pins - IN or OUT

1. Master arm switch - SAFE
   With the master arm switch in SAFE, the arm nose tail switch is inoperative. The master arm switch is used only with single bomb suspension. If the bombs are to be released ARMED, place the master arm switch to ARM and the arm nose tail switch to NOSE or NOSE & TAIL. The heat missiles and the launchers cannot be released with the nuclear release circuit.
2. Delivery mode selector knob - DIRECT
   The DIRECT mode is used to provide an immediate release when the bomb button is depressed.
3. DCU-94/A station selector switch - FORWARD (DESIRED STATION)
4. DCU-94/A master release lock switch - FORWARD
   a. DCU-94/A wing station UNLOCKED light (if selected) - ON

Note

If the inflight lockout pins are not installed, the wing station UNLOCKED light illuminates after step 4. If the inflight lockout pins are installed, these lights illuminate continuously.

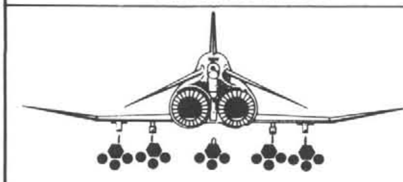
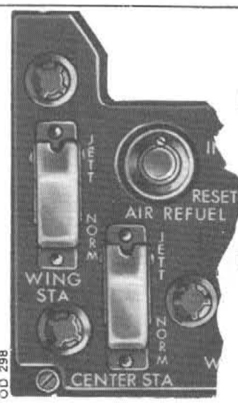
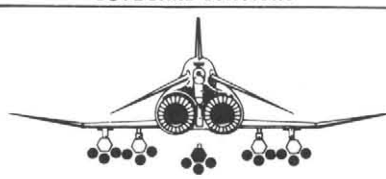
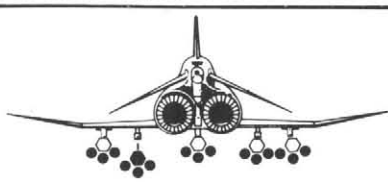
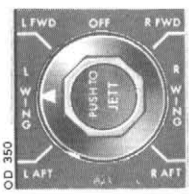
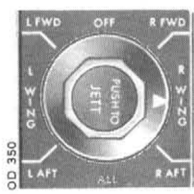
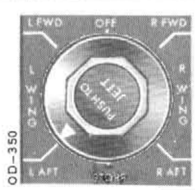
5. (P) Nuclear store consent switch - REL or REL/ARM
   a. DCU-94/A CL UNLOCKED light (if the CL station is selected) - ON
6. Bomb button - DEPRESS
   The suspension equipment or the single suspended bomb on the selected station will be released when the bomb button is depressed.
7. For remaining station(s), place the station selector AFT and repeat steps 3 and 6.

JETTISON WITH THE NUCLEAR JETTISON CIRCUIT

The following procedures apply to bombs and MER/TER's that are suspended directly from the armament pylon or the centerline bomb rack:

JETTISON CHART F-4E

BEFORE T.O. 1F-4E-556

STATION JETTISON	JETTISON CONTROL		JETT. PROCEDURE	LOCATION
 MULTI–STATION		1 EXTERNAL STORES EMERGENCY RELEASE (PANIC BUTTON) 2	PUSH	LEFT SUB PANEL
 OUTBOARD STATIONS		3 WING STATION JETTISON SWITCH	POSITION UP TO JETT	FUEL CONTROL PANEL
 CENTERLINE STATION		1 CENTERLINE STATION JETTISON SWITCH	POSITION UP TO JETT	FUEL CONTROL PANEL
 LEFT INBOARD STATION		1 MISSILE JETTISON KNOB 4	1. L WING POSITION – 2. PUSH CENTER BUTTON	MISSILE STATUS PANEL
 RIGHT INBOARD STATION		1 MISSILE JETTISON KNOB 4	1. R WING POSITION – 2. PUSH CENTER BUTTON	MISSILE STATUS PANEL
 RADAR MISSILES		1 MISSILE JETTISON (ONE STATION CONSIDERED) 5	1. SELECT FUS. STATION 2. PUSH TO JETT	MISSILE STATUS PANEL

Notes

- See T.O. 1F–4C–1 for jettison limits.
- Pylon inflight lockout pins must be installed.
- Fuselage ECM pods are non–jettisonable; cartridges are not installed in wing/CL stations with ECM pods aboard.

1 Emer gear handle IN with weight off gear or gear handle UP; or armament safety override button IN.

2 Heat and RDR missiles do not jettison.

3 Switch is HOT with EXT or GEN or GEN power ON.

4 Wing flaps must be UP to jett heat missiles; gear UP for AIM–4D

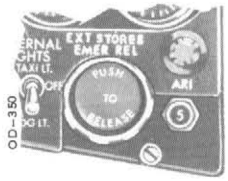
5 Station 4 and 6 RDR missiles cannot jett with fuel tank or MER aboard CL station.

4C–34–1–1–(154–1)

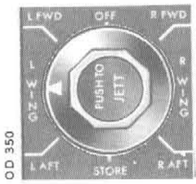
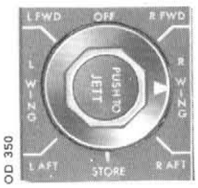
Figure 3-3 (Sheet 1 of 3)

JETTISON CHART F-4E (CONTINUED)

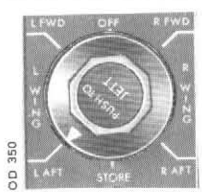
AFTER T.O. 1F-4E-556

MULTI-STATION JETTISON	JETTISON CONTROL		JETT PROCEDURE	LOCATION
		EXTERNAL STORES EMERGENCY RELEASE (PANIC BUTTON) 1	PUSH	LEFT SUB PANEL

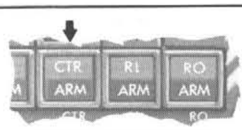
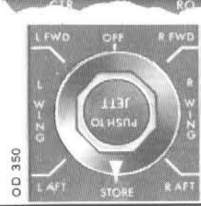
AGM–65 & HEAT MISSILE JETTISON

		SELECTIVE JETTISON 2	1. SELECT L WING 2. PUSH TO JETT	MAIN INSTRUMENT PANEL
		SELECTIVE JETTISON 2	1. SELECT R WING 2. PUSH TO JETT	MAIN INSTRUMENT PANEL

RADAR MISSILES

		SELECTIVE JETTISON (ONE STATION CONSIDERED) 3	1. SELECT FUS. STATION 2. PUSH TO JETT	MAIN INSTRUMENT PANEL

WING & CL STORES

	 	STATION SELECT BUTTON(S) SELECTIVE JETTISON 4	1. Depress desired station(s) (CL station considered). 2. Select stores. 3. PUSH TO JETT	MAIN INSTRUMENT PANEL

1. Heat and RDR missiles do not jettison
2. Wing flaps must be up. This procedure jettisons a single AGM–65 missile.
3. Station 4 and 6 RDR missiles cannot jettison with fuel tank or MER aboard the CL station.
4. Heat missiles will not jettison.

Notes

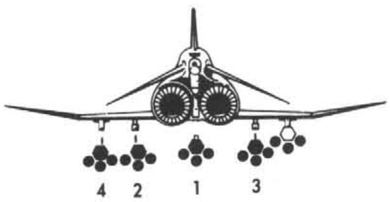
- For all jettison, emer gear handle must be IN with weight off left main gear or the landing gear must be UP; or Arm Safety Override button pushed IN.
- Pylon inflight lockout pins must be installed.
- Fuselage ECM pods are non-jettisonable; cartridges are not installed in wing/CL stations with ECM pods aboard.
- Refer to T.O. 1F-4C-1 for jettison limitations.

4C-34-1-1-(154-2)

Figure 3-3 (Sheet 2 of 3)

JETTISON CHART F-4E (CONTINUED)

DCU-94/A RELEASE

STATION JETTISON	SWITCH		SWITCH POSITION
RELEASE		DELIVERY MODE SELECTOR KNOB	DIRECT
		APPLICABLE STATION SELECTOR SWITCH	FORWARD
		MASTER RELEASE LOCK SWITCH	FORWARD
		NUCLEAR STORE CONSENT SWITCH	REL OR REL/ARM
		BOMB RELEASE BUTTON	DEPRESS
		SELECTED STATION SELECTOR SWITCH (Repeat above procedures for each station.)	AFT

Notes

1. The inflight lockout pins may or may not be installed.
2. RO station can not be jettisoned.
3. AGM–12B, AGM–45, and Heat missiles can not be jettisoned.

4C-34-1-1-(154-3)

Figure 3-3 (Sheet 3 of 3)

Note

The inflight lockout pins may be IN or OUT.

1. Master arm switch - SAFE (if applicable)
   With the master arm switch in SAFE, the arm nose tail switch is inoperative. The master arm switch is used only with single bomb suspension. If the bombs are to be released ARMED, place the master arm switch to ARM and the arm nose tail switch to NOSE or NOSE & TAIL. The AIM-4D missile and the launchers cannot be jettisoned with the nuclear jettison circuit.
2. DCU-94/A station selector switches (loaded stations) - FORWARD
3. DCU-94/A master release lock switch - FORWARD
   a. DCU-94/A wing station UNLOCKED lights (if selected) - ON
      If the inflight lockout pins are not installed, the wing station UNLOCKED lights illuminate after step 3. If the flight lockout pins are installed, these lights illuminate while power is on the aircraft.
4. (P) Nuclear store consent switch - REL or REL/ARM
   a. DCU-94/A CL UNLOCKED light, if the CL station is selected - ON
5. Nuclear store jettison button - PUSH

PART 4 EMERGENCY AIRCREW PROCEDURES F-4C D E

TABLE OF CONTENTS

FIRE FIGHTING AND EVACUATION

These emergency procedures consist of actions to be taken if munitions are involved in a fire. The aircrew should be thoroughly familiar with these procedures. Refer to T.O. 11A-1-55 for fire fighting information.

In event of a fire enveloping munitions, it is imperative that the time the fire envelops a munition be recorded. This action is required to determine time left to evacuate the area prior to munitions function.

The following table gives the withdrawal time in minutes and withdrawal distance in feet. At the expiration of the time factor in the table, the munition may be expected to function. The aircrew should withdraw to specified distance within applicable time limits after fire envelops munitions or after arrival of fire fighters, whichever occurs first. NA (Not Applicable) indicates that time or distance is not a factor.

TIME FACTOR AND EVACUATION DISTANCE CRITERIA

NOMENCLATURE	WITHDRAWAL TIME IN MINUTES	WITHDRAWAL DISTANCE IN FEET FOR NONESSENTIAL PERSONNEL
All Fire Bombs.	NA	500
Flares, Markers and Practice Bombs: SUU-20, -21, -25, -42 Series; LUU-1/B, -2/B, -5/B, -6/B; MK 24 Mod 4; BDU-33 and MK106	NA	500
Leaflet Bombs M129E1, E2	NA	500
Incendiary Cluster Bomb M36E2	NA	500
Ejector Rack Cartridges	NA	500
20mm Cartridges T.P. (Ball)	NA	500
Dispenser and Bomb CBU-9 Series	NA	100
20mm Cartridges HEI, API	1.0	2000
GP Bomb with M1A1 Fuze Extender	1.0	2000
Dispenser and Mine CBU-33/A, CBU-34 Series, and CBU-42/A	1.5	2000
Cluster Bomb, Anti-Tank, MK 20 Mod 2	1.5	2000
Spray Tanks:		
A/B45Y-1 and A/B45Y-4	1.5	2 Miles Downwind
TMU-28/B	1.5	1 Mile Sidewind 1 Mile Upwind
A/B45Y-2	NA	2000
PAU-7/A	NA	NA
Dispensers and Bombs: CBU-1A/A, CBU-2, CBU-7A/A, CBU-12, CBU-24, CBU-29, CBU-30/A, CBU-38, CBU-46/A, CBU-49, CBU-52A/B, CBU-58, CBU-70, SUU-41 Loaded, Rockeye II	1.5	2000
Gas Bomb MC-1	5.0	2 Miles Downwind 1 Mile Sidewind 1 Mile Upwind
Chemical Bombs BLU-52/B, A/B	NA	2000
Guided Weapons: MK 1 Mod 0, 2, 6 and 7 (Walleye)	5.0	2000
Bomb/Destructor: BLU-31, KMU-351, KMU-353, KMU-370, KMU-388, KMU-390, M117, M117D, M118, MK36, MK82, MK83, MK84	5.0	2000

WARNING

Personnel must remain clear of the area to the fore and aft of rockets and missiles during firefighting and evacuation.

Rockets:		
2.75 Inch (All Warheads)	2.5	2000
5 Inch HVAR, Target, TDU-11/B	2.5	2000
Missiles:		
AGM-12B	1.75	2000
AGM-12C, E	2.5	2000
AGM-45A	1.0	2000
AIM-4D-8, -7D, E, E2, -9B, E	1.0	2000

RMU-8/A TOW TARGET SYSTEM EMERGENCY PROCEDURES

The emergency procedures described herein are for emergency operation of the F-4C, F-4D, and F-4E aircraft with the tow system installed. These procedures represent changes and additions to the basic aircraft emergency procedures for purposes of emergency operation with the tow system.

Note

Procedural headings followed by TSO refer to the tow system operator and those left blank refer to the AC.

EJECTION

EJECTION (AC)

1. Advise TSO of ejection and obtain immediate acknowledgement that target is stowed or towline is cut.
2. Continue with established ejection procedures.

EJECTION (TSO)

When Advised by AC to Eject, Immediately

1. Cut the towline unless target is stowed.
2. Call "towline cut" or "target stowed".
3. Continue with established ejection procedures.

BARRIER ENGAGEMENT (TSO)

1. Do not jettison target on runway.

REEL OVERSPEED (TSO)

If Reel Speed Exceeds 5500 FPM (Matching Control Panels with Reel)

1. Advise AC to slow aircraft to minimum safe flying speed.
2. Normal stop switch - ACTUATE
   Allow reel to come to a complete stop.
3. Reel-in and recover target.

If Reel Exceeds 6000 FPM

1. Advise AC to rapidly reduce airspeed to a minimum safe flying speed and lower landing gear when airspeed is below 250 KCAS. The nose gear will tend to spoil the airflow to the turbine.
2. Emergency stop and cut switch - ACTUATE
3. Be prepared to jettison reel if turbine begins to disintegrate.
4. If turbine speed is controlled below 6000 FPM, land as soon as possible. If available, request escort aircraft to maintain visual confirmation of reel condition.

EXCESSIVE VIBRATION (TSO)

1. Excessive vibration could occur due to aircraft or tow reel malfunctions. If reel is not operating, do not take any action until advised by AC.
2. If excessive vibration occurs during launch or reel-out, actuate normal stop switch and allow reel to stop. If vibration ceases as reel slows down, the level wind is probably out of synchronization. Recover target and terminate mission.
3. If vibration occurs during reel-in or recovery and continues after normal stop has been accomplished, the difficulty is probably in the aircraft. Target should be immediately recovered or cable cut as directed by AC.

TOW SYSTEM EMERGENCY POWER LIGHT ILLUMINATED (TSO)

Note

The emergency power light is illuminated if normal aircraft power is momentarily interrupted. During operation with emergency power, all normal functioning of the system is automatically stopped and control switches are inoperative except the emergency stop and cut switch. If reel is in operation a normal stop is automatically initiated. To resume normal operation, the tow master switch must be cycled to OFF and back to ON.

1. If reel is in operation, wait for reel to stop.
2. Tow master switch - OFF
3. If RMU-8/A circuit breaker(s) on No. 3 circuit breaker panel has popped - RESET
4. Tow master switch - ON
5. If normal power is restored, continue mission.

If Normal Aircraft Power Cannot Be Restored

6. Tow master switch - ON
7. Emergency stop and cut switch - ACTUATE

CAUTION

If circuit breaker(s) pop twice, reset emergency power circuit breaker, and actuate emergency stop and cut switch.

TOW SYSTEM HIGH OIL TEMPERATURE LIGHT ILLUMINATED (TSO)

1. Normal stop switch - ACTUATE
2. Wait 10 minutes.
3. High oil temperature light - OUT
4. Continue mission.

5. If high oil temperature light and low oil pressure light come on simultaneously during reel-out or reel-in, actuate emergency stop and cut switch.

TOW SYSTEM LOW OIL PRESSURE LIGHT ILLUMINATED (TSO)

Note

This light may be illuminated during launch and recovery, and will be on until reel speed reaches about 2500 fpm during reel-out or reel-in.

1. If light fails to go out at 3500 fpm during reel-out, actuate normal stop switch.
2. If light fails to go out at 3500 fpm during reel-in, immediately actuate emergency stop and cut switch.

TOW SYSTEM LOW AIR LIGHT ILLUMINATED (TSO)

1. If light illuminates prior to launch, do not attempt to operate system. Terminate mission and land as soon as practicable.
2. If light illuminates after several reel cycles, recover target.

If Light Illuminates For No Apparent Reason

3. If launcher is lowered, make every possible attempt to recover target because pressure may not be available to retract launcher if towline is cut or broken.

TARGET OUT LIGHT ILLUMINATED WITH TARGET STOWED (TSO)

1. Advise AC to reduce airspeed to minimum safe flight speed.
2. Obtain visual confirmation from another aircraft if possible.
3. Advise AC to land as soon as practicable using a straight-in approach.

LAUNCHER FAILS TO LATCH AT LAUNCH STOP (TSO)

1. Advise AC to stay below minimum launcher down speed (475 KCAS or 0.9 Mach, whichever is lower).
2. Normal stop switch - ACTUATE
   Launcher should retract and lock up.

If Launcher is Still Reported Down by Chase Plane

3. Reel-out/reel-in switch - REEL-OUT
4. Normal stop switch actuates after approximately 1000 feet of cable is reeled out.
5. Launch/recover switch - RECOVER TARGET
6. Normal stop switch - ACTUATE

Note

Steps 5 and 6 recycle the launcher. If light goes out or chase plane reports launcher full up, continue mission. If launcher down light stays illuminated or chase plane reports launcher hanging, recover target and terminate mission. Air pressure may be depleted if mission is continued.

LAUNCHER FAILS TO LATCH ON RECOVERY (TSO)

1. Recovery speed switch - INCREASE

CAUTION

Do not exceed towline leader breathing strength

2. If target light is out and launcher down light is illuminated, perform the following steps at 3 second intervals:
   a. Launch/recovery switch- LAUNCH TARGET
   b. Normal stop switch - ACTUATE
      This will cycle the launcher.
3. If chase plane reports target in clamps in normal locked position, advise AC to proceed with straight in approach landing.
4. If no chase plane is available or chase plane reports target below clamps or lodged in clamps, perform the following steps:
   a. Normal stop switch - ACTUATED
   b. Tow master switch cycled - OFF THEN ON
   c. Launch/recovery switch - RECOVER TARGET
   d. Recovery speed switch - INCREASE (MAXIMUM)
   e. Increase airspeed - 300 KCAS
   f. If launcher does not latch, actuate emergency stop and cut switch.
5. If launcher fails to latch, advise AC to perform a normal landing with launcher down. Launcher will clear runway during landing. The TSO should request ground crew to meet the aircraft when taxiing from runway to lock the launcher up.

TOWLINE FAILURE (TSO)

1. If towline failure occurs during the launch or reel-out cycle, actuate the emergency stop and cut switch.

REEL FAILS TO STOP AT A PRESET STOP (TSO)

Note

If reel fails to stop or decelerate, or towline speed stabilizes below normal operating range, the difficulty is probably the acceleration monitor system or a defective pitch change actuator. The following steps should be performed in 5 second intervals.

REEL FAILS TO STOP AT PRESET OUT-STOP

1. Advise AC to slow aircraft to a minimum safe flying speed.
2. Normal stop switch - ACTUATED
3. RMU-8/A 15 amp circuit breaker on indicator panel - PULL OUT
   This step places the system on emergency power.
4. RMU-8/A 5 amp circuit breaker on No. 3 circuit breaker panel (zone D12) - PULL OUT
   Pulling this circuit breaker, deactivates the speed monitor system.

If No Decrease In Towline Speed (FPM) is Noted After Performing the Preceding Steps

5. Tow reel master switch - OFF
   Placing the tow master switch to OFF sets the turbine brake.
6. Allow reel to come to a complete stop.
7. Obtain conformation of turbine position from chase plane.
8. If chase plane reports turbine blades to be in reel-out position, reset 15 amp RMU-8/A circuit breaker on indicator panel.
9. Tow master switch - ON
10. If blades do not feather, actuate normal stop switch.
11. Reel-in/reel-out switch - REEL-IN
12. When towline speed indicator reads zero fpm, actuate normal stop switch.
13. Reset 5 amp circuit breaker on No. 3 circuit breaker panel (zone D12).
14. Continue mission.

Note

Auto cut armed light will remain on.

REEL FAILS TO STOP AT PRESET IN-STOP

CAUTION

Due to small amount of towline, the following steps should be performed at 3 second intervals or until there is a definite decrease in towline speed or until reel has completely stopped.

1. Normal stop switch - ACTUATE
2. Advise AC to slow aircraft to minimum safe flying speed.
3. RMU-8/A 15 amp circuit breaker on indicator panel - PULL OUT
4. RMU-8/A 5 amp circuit breaker on No. 3 circuit breaker panel (zone D12) - PULL OUT
5. Tow reel master switch - OFF

After Reel Has Stopped

6. Obtain confirmation from chase plane of turbine position.
7. If chase plane confirms turbine blades in feather position, reset all circuit breakers and continue normal recovery procedures.
8. If chase plane reports the turbine blades in a reel-in angle, reset 15 amp circuit breaker on RMU-8/A indicator panel.
9. Tow master switch - ON
10. If turbine blades are not feathered, actuate normal stop switch.
11. Reel-in/reel-out switch - REEL-OUT
12. When towline speed indicator reads zero fpm, actuate normal stop switch.
13. RMU-8/A 5 amp circuit breaker on No. 3 circuit breaker panel (zone D12) - RESET-IN
14. Continue with normal recovery procedures.

TARGET SHOT OFF (AC-TSO)

1. Normal procedures are utilized for cable recovery (300 KCAS descent to recovery altitude of 15,000 to 20,000 feet).

TARGET SHOT OFF (TSO)

1. Reel-out/reel-in switch - REEL-IN
2. After passing preset in-stop and reel has stopped, if no chase plane is available, actuate emergency stop and cut switch.
3. After the reel has stopped after passing preset in-stop and chase plane is available, perform the following procedures:
   a. Launch/recovery switch - RECOVER TARGET
   b. Utilize normal recovery procedures.
   c. Actuate emergency stop and cut switch when chase plane advises of excessive whipping or balling or when cable length reaches 25 feet in length.

FLARE IGNITION DURING TAXIING OR ENGINE START

CAUTION

When utilizing TDU-22A/B with TAU-15B infrared flares, pre-flare ignition may occur during engine start or taxiing.

Flare Ignition During Engine Start or Taxiing (AC)

1. Expedite engine start and prepare for immediate taxi of aircraft.
2. Taxi aircraft from parking and stop when advised by TSO.
3. If flare ignition occurs in route to runway, expedite taxi.

Flare Ignition During Engine Start or Taxiing (TSO)

1. When advised by ground crew that flares have ignited and all personnel are clear of the launcher assembly, the following procedures should be followed:
   a. Tow master switch - ON
   b. Launch/recovery switch - LAUNCH TARGET
   c. Emergency stop and cut switch - ACTUATE
   d. Advise AC to expedite taxi of aircraft.

Flare Ignition During Takeoff or In Flight With Target Stowed In Launcher (TSO)

1. When advised by chase plane that flare ignition has occurred, actuate the launch/recovery switch to LAUNCH TARGET.

CAUTION

Do not attempt to recover target until an attempt has been made to fire all flares, and until the target relay is stepped to the safe position.

SECTION IV SUPPLEMENTARY DATA

TABLE OF CONTENTS

SAFE SEPARATION DATA

M117; MK 82, 83 LDGP; AND MC-1 BOMBS

The release conditions listed in the bombing tables for these items provide a minimum of 100 feet AGL recovery altitude. The 100-foot minimum altitude is based on a 4.0 G pullout acceleration with 4.0 G obtained in 2.0 seconds after the stated release altitude. Based on studies of data available to date, the minimum release altitudes listed in the Fuzing and Safe Escape Charts should provide safe escape from the bomb fragments for all contact burst and airburst (VT fuze) situations.

BLU-31/B LAND MINE

WARNING

- When the FMU-30/B fuze is used with the BLU-31/B land mine, minimum release altitudes which provide safe escape from bomb fragments for instantaneous or contact bursts shall be selected. This is required to protect the aircraft and aircrew in the event of premature bomb detonation at initial impact. Refer to Safe Escape, figure 6-14.
- For BLU-31/B land mine shapes, the trajectory angle at impact shall be in excess of 15° to preclude ricochet.

The land mine with the FMU-30/B Fuze has been successfully tested for impact velocities up to 900 ft/sec. Release conditions which result in impact velocities of 900 ft/sec or less should be selected during mission planning. Refer to section VI, MLU-10/B and BLU-31/B Impact Velocity tables, T.O. 1F-4C-34-1-2.

(No ricochet data are available for the BDU-33/B practice bombs.)

2.75" FFAR

Based on limited data available from static firing, the minimum launch altitudes listed in section VI, Safe Escape, may be used. If the rockets are launched above these altitudes, the aircraft should not penetrate the fragment envelope during the assumed 4.0 G (in 2.0 sec) pullout. Refer to the Safe Escape chart, figure 6-14.

MAXIMUM FRAGMENT ENVELOPE CHARTS

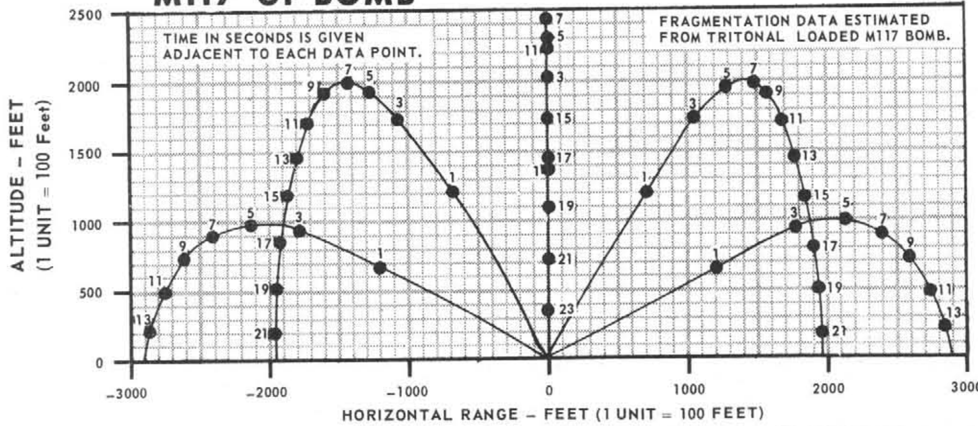
The Maximum Fragment Envelope charts figure 4-1 show the fragment position relative to the weapon burst point as a function of time, and are used in determining the safe release interval between aircraft during multiple aircraft attacks. The charts are based on the assumption that the most hazardous fragment (i.e., the heaviest fragment with the maximum velocity) can be projected from the burst point at any angle, irrespective of weapon delivery conditions. Similar charts for 2.75-inch rockets are given as a function of impact angle where the impact angle is approximately equal to the aircraft dive angle. The rocket envelopes may be rotated for consideration of launch angles other than those given.

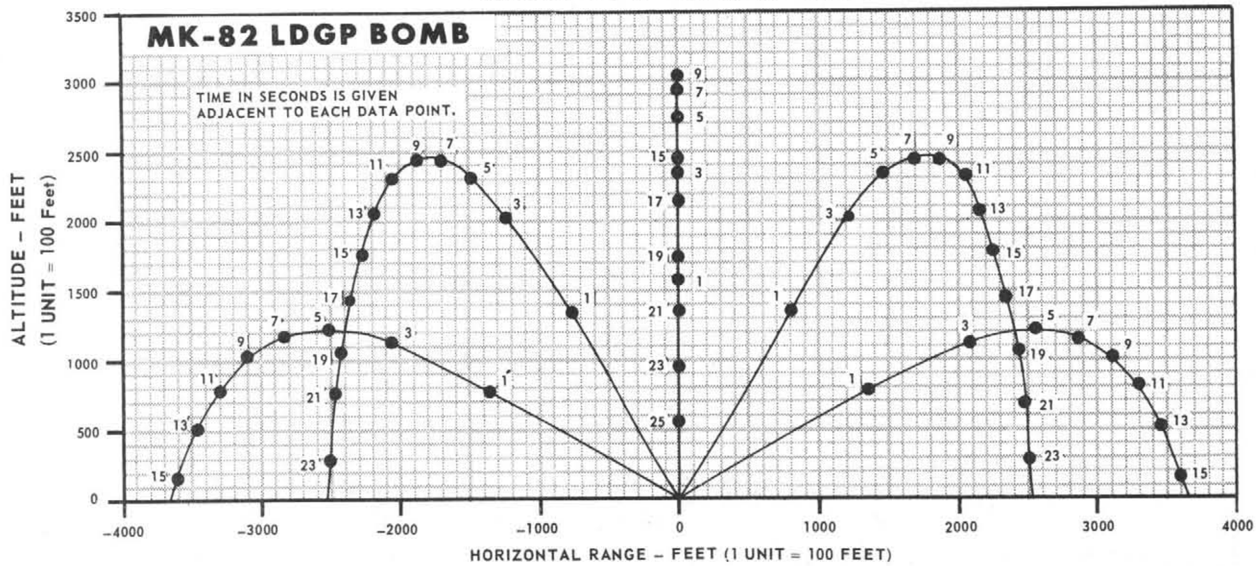
SUMMARY

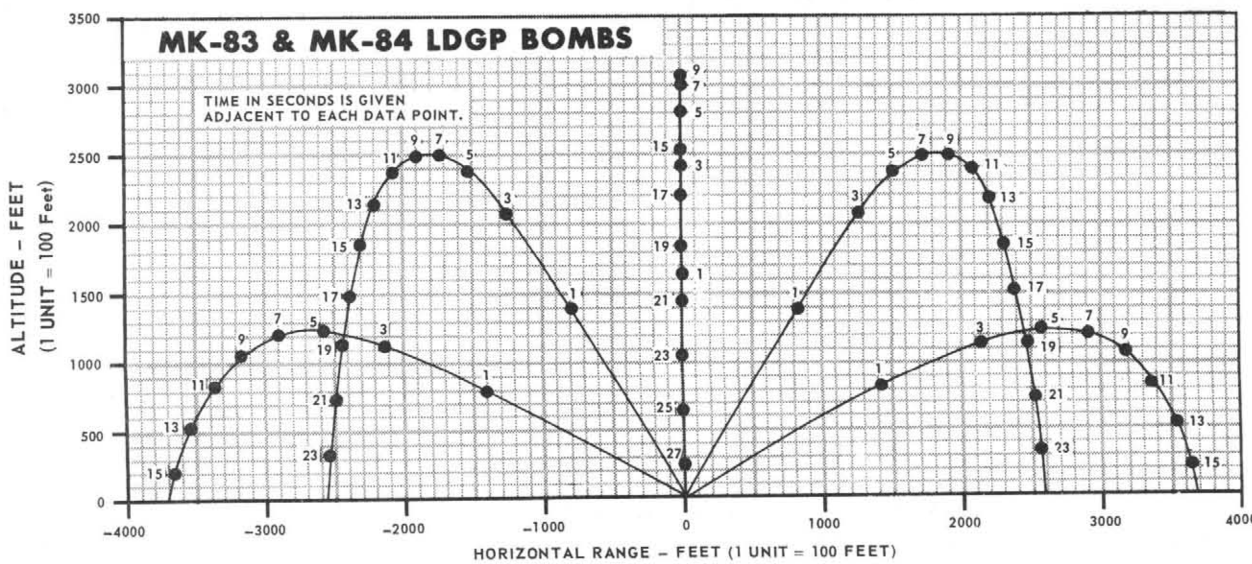
Additional and more detailed bomb and rocket fragmentation data will be included in this publication as studies and tests are completed by the Ballistics Division, Directorate of Armament Division, Eglin AFB, Fla. during Project 9088, Aircraft/Munitions Safe Separation Evaluation. The bomb and rocket release conditions will be changed to include new minimum conditions as they are determined.

MAXIMUM FRAGMENT ENVELOPE

M117 GP BOMB







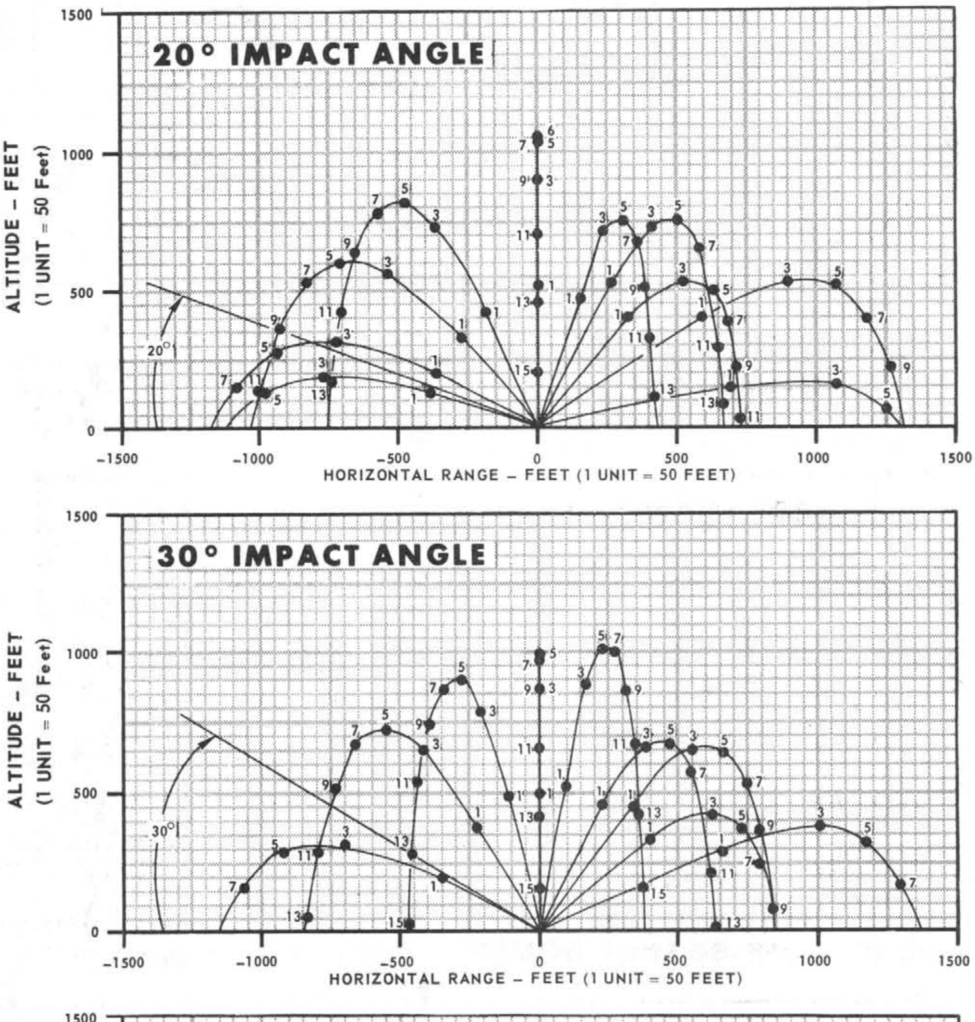
F4-34-IV-112-1

Figure 4-1 (Sheet 1 of 3)

MAXIMUM FRAGMENT ENVELOPE

2.75-INCH FFAR WITH MK I WARHEAD

NOTE
TIME IN SECONDS IS GIVEN
ADJACENT TO EACH POINT



F4-34-IV-112-2

Figure 4-1 (Sheet 2 of 3)

MAXIMUM FRAGMENT ENVELOPE
2.75 - INCH FFAR WITH M151 WARHEAD

NOTE
FRAGMENT TIME IN SECONDS IS GIVEN ADJACENT TO EACH DATA POINT

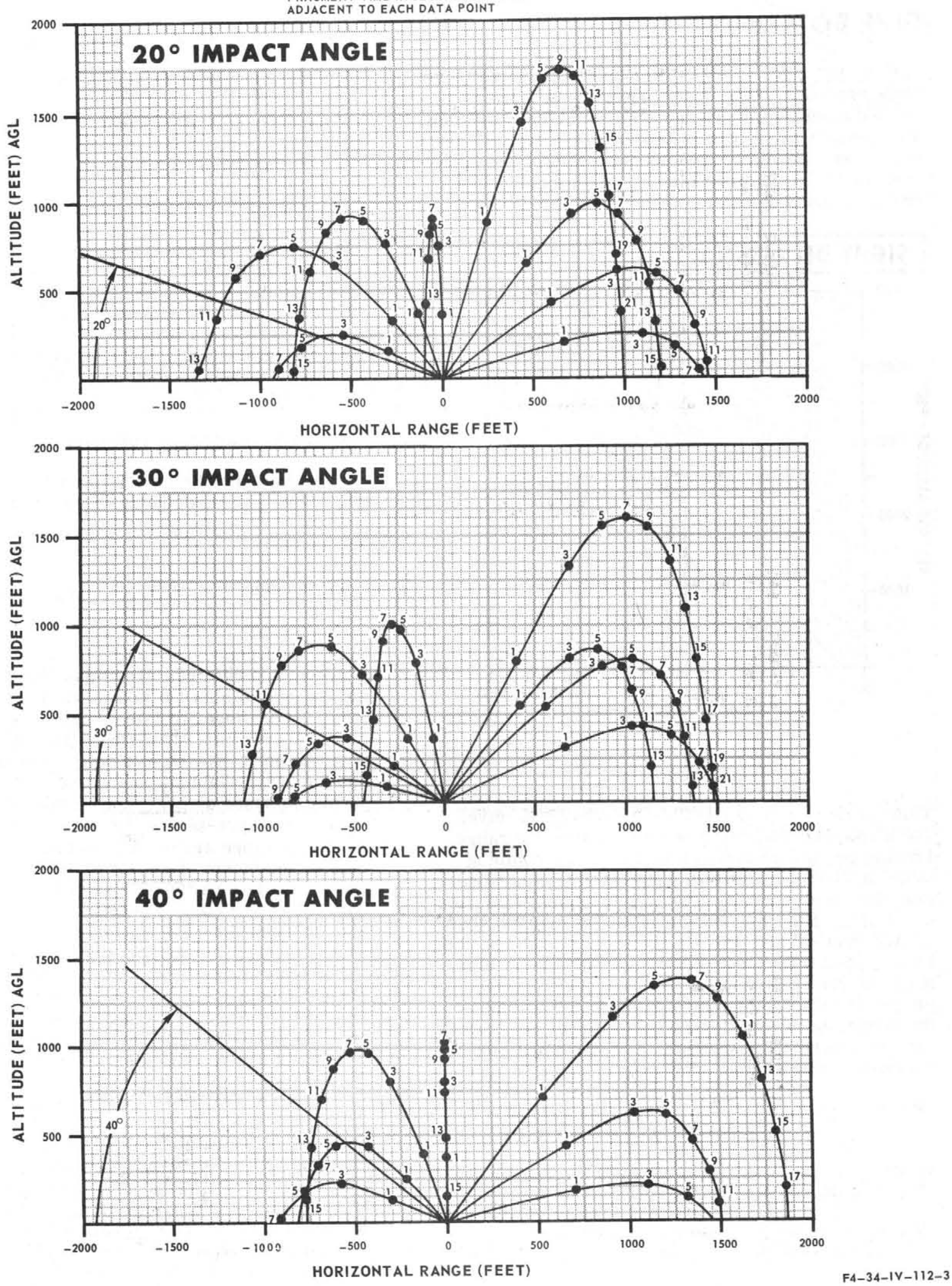


Figure 4-1 (Sheet 3 of 3)

ERROR ANALYSIS

DIVE BOMBING

In this mode, the bomb is released from a fixed dive angle approach to the target. Release is accomplished manually at preplanned airspeed and altitude. The aircraft flight path is projected beyond the target, by means of a depressed sight line, to compensate for the curvature of the bomb trajectory. See chart, figure 4-2.

SIGHT DEPRESSION

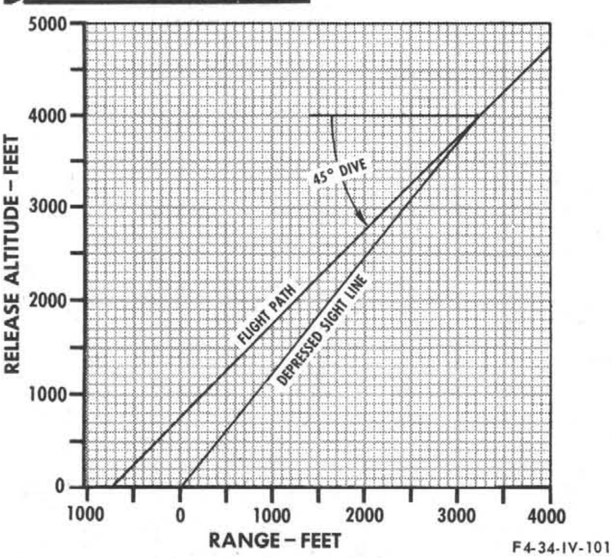


Figure 4-2

This chart is drawn to scale for an M117 45° dive, 420 KTAS, 4000 ft. AGL release. The bomb range for this release condition (obtained from bombing table) is 3242 ft. Therefore, for this release condition, the bomb must be released at a horizontal distance of 3242 ft. from the target at the planned 4000 ft. AGL and 45° dive angle. If the 45° dive flight path is projected from the release point into the ground, it can be seen that sight depression, sufficient to project the flight path approximately 760 ft. beyond the target, is required to compensate for the trajectory curvature. The formula used to compute depression settings is as follows:

$$\phi = 17.45\left[\tan^{-1}\frac{Y_P}{R_P \pm W_R t} - |\theta|\right] + \alpha - \beta$$

where:

ϕ = sight depression in mils.

$Y_P = Y_R$ - (X parallax factor) $\sin|\theta|$ + (Y parallax factor) $\cos|\theta|$

$R_P = R$ - (X parallax factor) $\cos|\theta|$ - (Y parallax factor) $\sin|\theta|$ + R_C

Y_R = release altitude (AGL) in feet.

R = bomb range in feet under no-wind conditions.

X parallax factor = 18 feet.

Y parallax factor = 7 feet.

R_C = range correction factor

W_R = release rangewind component in feet/second. Headwind is minus; tailwind is plus.

t = bomb time of flight in seconds.

θ = release angle in degrees. This is the angle between the horizontal and the aircraft flight path.

α = angle of attack at release in mils.

β = zero sight line orientation with respect to the aircraft fuselage reference line in mils.

The quantity

$$17.45\left[\tan^{-1}\frac{Y_P}{R_P + W_R t} - |\theta|\right]$$

in the sight depression angle formula represents the depression angle from flight path which is listed in the bombing tables. It is a function of release altitude, bomb range, and dive angle. Bomb range, in turn, is a function of release altitude, dive angle, true airspeed, ejection velocity, and effective drag. Since many variables are involved and the depression setting is based on pre-planned conditions, any deviation from pre-planned conditions is bound to result in impact range error. The following paragraphs indicate the amount of impact error to be expected for certain deviations from planned release TAS, altitude, or dive angle. The following standard or planned conditions are assumed:

a. Release TAS:	420 kts
b. Release Alt:	4000 ft AGL
c. Release Angle:	-45°
d. Aircraft Gross Weight:	38000 lbs
e. Temperature at Release - Altitude:	-18°C
f. Wind:	Calm

For these conditions, the sight depression from flight path is 106 mils and the aircraft angle of attack at release is 16.66 mils. For simplicity, it will be assumed that the zero sight line coincides with the aircraft FRL. This is valid because actual depression angle from flight path is all that matters. Using this assumption, the release depression setting would be 122.66 mils (sum of depression from flight path and angle of attack). With a fixed depression setting assumed, the following equation can be

derived to determine an offset aimpoint required for a hit if the actual release condition is different from the planned release conditions.

$$A = R_P - Y_P \text{ Cot } \left[\theta + \frac{\phi - \alpha_A + \alpha_P}{17.45}\right]$$

or

$$A = R_P - Y_P \text{ Cot } [\theta + (\phi - \alpha_A + \alpha_P)(0.0573)]$$

where:

A = offset aimpoint in feet.

$Y_P = Y_R$ - (X parallax factor) sin $|\theta|$ + (Y parallax factor) cos $|\theta|$

$R_P = R$ - (X parallax factor) cos $|\theta|$ - (Y parallax factor) sin $|\theta| + R_C$

Y_R = release altitude (AGL) in feet.

R = bomb range in feet.

R_C = range correction factor (= 0 in sample that follow)

X parallax factor = 18 feet.

Y parallax factor = 7 feet.

α_A = actual angle of attack at release in mils.

θ = release dive angle in degrees.

α_P = planned angle of attack at release in mils.

ϕ = planned depression angle from flight path in mils.

1 mil = 0.0573 degree.

1 degree = 17.45 mils.

A is an aimpoint offset. If the bomb is released with the depressed sight on the target, it can be used to represent impact error. The Y_P Cot [ ] part of the formula provides the horizontal distance from release to target for the actual release condition. A negative A (offset) indicates a negative (short) error, and a positive A (offset) indicates a positive (long) error. The offset is zero if all conditions are met.

EFFECT OF RELEASE TAS ERROR

TAS = 400 kts (20 knots slower than planned) 45° dive, 4000 ft AGL, α_A = 20.00 mils and R = 3192 feet. Substituting in the A equation, we have:

$$A = 3174 - 3992 \text{ Cot } \left[45^\circ + \frac{106 - 20.00 + 16.66}{17.45}\right]$$

A = -73 ft (short error)

TAS = 440 kts (20 kts faster than planned) 45° dive, 4000 ft AGL. Using same procedure, α_A = 13.81 mils and R = 3288 ft.

$$A = 3270 - 3992 \text{ Cot } \left[45^\circ + \frac{106 - 13.81 + 16.66}{17.45}\right]$$

A = 65 ft (long error)

EFFECT OF RELEASE ALTITUDE ERROR

Altitude = 3800 ft (200 ft lower than planned) 45° dive, 420 KTAS, α_A = 16.66 and R = 3102 ft.

$$A = 3084 - 3792 \text{ Cot } \left[45^\circ + \frac{106 - 16.66 + 16.66}{17.45}\right]$$

A = 21 ft (long error)

Altitude - 4200 ft (200 ft higher than planned) 45° dive, 420 KTAS, α_A = 16.66 and R = 3377.

$$A = 3359 - 4192 \text{ Cot } \left[45^\circ + \frac{106 - 16.66 + 16.66}{17.45}\right]$$

A = -27 ft (short error)

EFFECT OF DIVE ANGLE ERROR

Dive Angle = 40° (5° less than planned) 420 KTAS, 4000 ft AGL, α_A = 18.05 mils, R = 3749 ft.

$$A = 3731 - 3994 \text{ Cot } \left[40^\circ + \frac{106 - 18.05 + 16.66}{17.45}\right]$$

A = -127 ft (short error)

Dive Angle = 50° (5° steeper than planned) 420 KTAS, 4000 ft AGL, α_A = 15.14 mils, R = 2782 ft.

$$A = 2765 - 3991 \text{ Cot } \left[50^\circ + \frac{106 - 15.14 + 16.66}{17.45}\right]$$

A = 89 ft (long error)

LOW LEVEL BOMBING ERROR ANALYSIS

In this mode, the bomb is released from a low altitude level approach at planned airspeed and altitude above ground. If the depressed sight line is used for estimating the release point, the procedure used for the dive bombing error analysis may be used to estimate low level bomb error resulting from deviation from planned conditions. Standard conditions assumed are for release of a BDU-33/B from SUU-21/A dispenser.

a. Release TAS:	420 kts
b. Release Altitude:	50 ft
c. Release Angle:	0°
d. Aircraft Gross Weight:	38000 lbs
e. Temperature at Release Altitude:	16°C
f. Wind:	Calm

For these conditions, the sight depression angle from flight path is 61 mils, and the angle of attack is 23.56 mils.

EFFECT OF RELEASE TAS ERROR

TAS = 400 kts (20 kts slower than planned) 0° Release Angle, 50 ft AGL, α_A = 28.29, R = 911.

$$A = 893 - 57 \text{ Cot } \left[0^\circ + \frac{61 - 28.29 + 23.56}{17.45}\right]$$

A = -120 ft (short error)

TAS = 440 kts (20 kts faster than planned) 0° Release Angle, 50 ft AGL, α_A = 19.54 mils, R = 1002 ft.

$$A = 984 - 57 \text{ Cot } \left[0^\circ + \frac{61 - 19.54 + 23.56}{17.45}\right]$$

A = 110 ft (long error)

EFFECT OF RELEASE ALTITUDE ERROR

Release Altitude = 40 ft (10 ft lower than planned) 0° Release Angle, 420 KTAS, α_A = 23.56 mils, R = 831 ft.

$$A = 831 - 47 \text{ Cot } \left[0^\circ - \frac{61 - 23.56 + 23.56}{17.45}\right]$$

A = 45 ft (long error)

Release Altitude = 60 ft (10 ft higher than planned) 0° Release Angle, 420 KTAS, α_A = 23.56 mils, R = 1071 ft.

$$A = 1053 - 67 \text{ Cot } \left[0^\circ + \frac{61 - 23.56 + 23.56}{17.45}\right]$$

A = -42 ft (short error)

EFFECT OF PITCH ANGLE ERROR

Pitch Angle = -1° instead of planned 0°, 50 ft AGL, 420 KTAS, α_A = 23.56 mils, R = 781 ft.

$$A = 763 - 57 \text{ Cot } \left[1^\circ + \frac{61 - 23.56 + 23.56}{17.45}\right]$$

A = 39 ft (long error)

Pitch Angle = +1° instead of planned 0°, 50 ft AGL, 420 KTAS, α_A = 23.56 mils, R = 1183 ft.

$$A = 1165 - 57 \text{ Cot } \left[-1^\circ + \frac{61 - 23.56 + 23.56}{17.45}\right]$$

A = -141 ft (short error)

ROCKET LAUNCHING 2.75-INCH FFAR

As in dive bombing, the depressed pipper is used to compensate for the curvature of the rocket trajectory from the launch point to impact. These projectiles can be delivered more accurately than a bomb under most circumstances because the high velocity attained after launch provides a flatter trajectory with less time of flight. Since the angle of attack is compensated for in the depressed sight settings, the following equation is used to compute the offset aimpoint for rocket or gun firing if the actual firing condition is different from the planned conditions:

$$A = R_P - Y_P \left[\text{Cot } \theta + \frac{\emptyset - \alpha}{17.45}\right]$$

where

A = impact error in feet

R_P = R - (X parallax factor) cos $|\theta|$ - (Y parallax factor) sin $|\theta|$

R = horizontal range for actual firing conditions in feet

Y_P = Y - (X parallax factor) sin $|\theta|$ + (Y parallax factor) cos $|\theta|$

Y = altitude (AGL) in feet at firing

X parallax factor = 18 feet

Y parallax factor = 7 feet

θ = dive angle in degrees at firing

$\emptyset$ = planned sight setting in mils

α_A = actual zero sight line angle of attack in mils

A negative A (offset) indicates a negative (short) error, and a positive A (offset) indicates a positive (long) error. The offset is zero if all conditions are met.

The following paragraphs indicate the amount of impact error to be expected for certain deviations from planned firing CAS, altitude, or dive angle. The following standard or planned conditions are assumed for launching a 2.75-Inch FFAR with MK-1 warhead:

a. Release CAS:	440 kts
b. Release Alt:	2500 ft AGL
c. Release Ang:	-30°
d. Aircraft Gross Weight:	40,000 lbs
e. Target Density Altitude:	5000 ft
f. Wind:	Calm

For these conditions the sight setting ($\emptyset$) is 38 mils. The aircraft angle of attack at release (α_A) is 17.5 mils.

EFFECT OF TAS ERROR

CAS = 420 kts (20 kts slower than planned), 30° dive, 2500 ft AGL, α_A = 20.5 mils and R = 4140 ft. Substituting in the A equation:

$$A = 4121 - 2497 \text{ Cot } \left[30 + \frac{38 - 20.5}{17.45}\right]$$

A = -35 ft (short error)

CAS = 460 kts (20 kts faster than planned), 30° dive, 2500 ft AGL, α_A = 14.5 mils and R = 4140 ft.

$$A = 4121 - 2497 \text{ Cot} \left[30 + \frac{38 - 14.5}{17.45}\right]$$

A = 22 ft (long error)

EFFECT OF ALTITUDE ERROR

Altitude = 2300 ft (200 ft lower than planned), 30° dive, 440 KCAS, α_A = 17.5 mils and R = 3818 ft.

$$A = 3799 - 2297 \text{ Cot} \left[30 + \frac{38 - 17.5}{17.45}\right]$$

A = 2 ft (long error)

Altitude = 2700 ft (200 ft higher than planned), 30° dive, 400 KCAS, α_A = 17.5 mils and R = 4463 ft.

$$A = 4444 - 2697 \text{ Cot} \left[30 + \frac{38 - 17.5}{17.45}\right]$$

A = -14 ft (short error)

EFFECT OF DIVE ANGLE ERROR

Dive angle = 25° (5° less than planned), 440 KCAS, 2500 ft AGL, α_A = 19 mils and R = 5080 ft.

$$A = 5061 - 2499 \text{ Cot} \left[25 + \frac{38 - 19}{17.45}\right]$$

A = -42 ft (short error)

Dive angle = 35° (5° more than planned), 440 KCAS, 2500 ft AGL, α_A = 15.5 mils and R = 3443 ft.

$$A = 3424 - 2495 \text{ Cot} \left[35 + \frac{38 - 15.5}{17.45}\right]$$

A = 26 ft (long error)

G-LOADING

One of the basic assumptions used in the dive bomb mission is that the bomb is released from a fixed-dive angle approach. Any increase in G-loading during the approach results in an increase in aircraft angle of attack. This decreases effective sight depression relative to the flight path and produces an undershoot (or short impact) situation. The converse is true for a decrease in G-loading.

ANGLE OF ATTACK vs G-LOADING

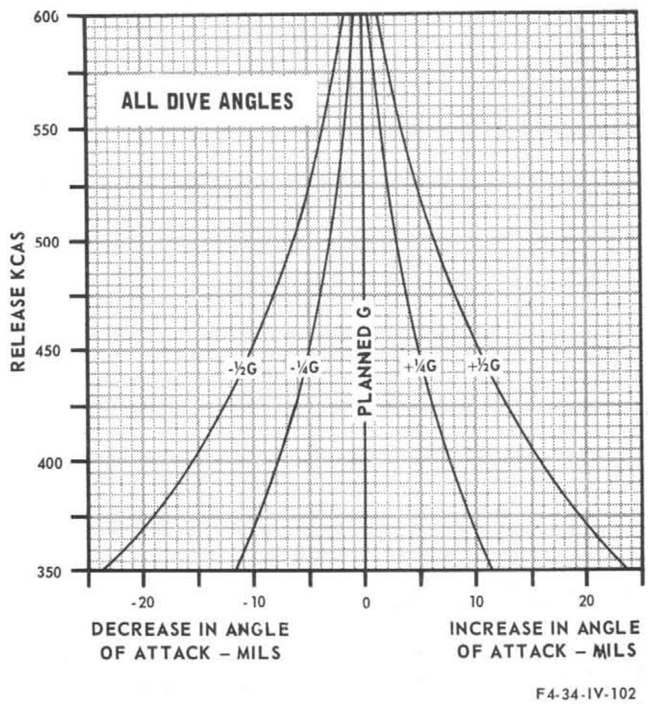


Figure 4-3

Normally, G-loading errors will result from an improper roll-in and the resulting improper initial tracking index position in relation to the target. If the initial tracking index position is too close to the target, the pipper will, during the dive, move up to the target prior to the pre-planned release altitude. In this case, a push-over (bunt maneuver) would be required to keep the tracking index from moving past the target. This would decrease angle of attack, increase dive angle and effective sight depression angle, and result in an overshoot. The validity of the sight depression setting computation is destroyed if a bunt maneuver is initiated, since the whole theory of the computation is based on a fixed dive angle approach. Figure 4-3 illustrates the effect of G-loading on angle of attack.

SIDESLIP ANGLE/BALL DEFLECTION

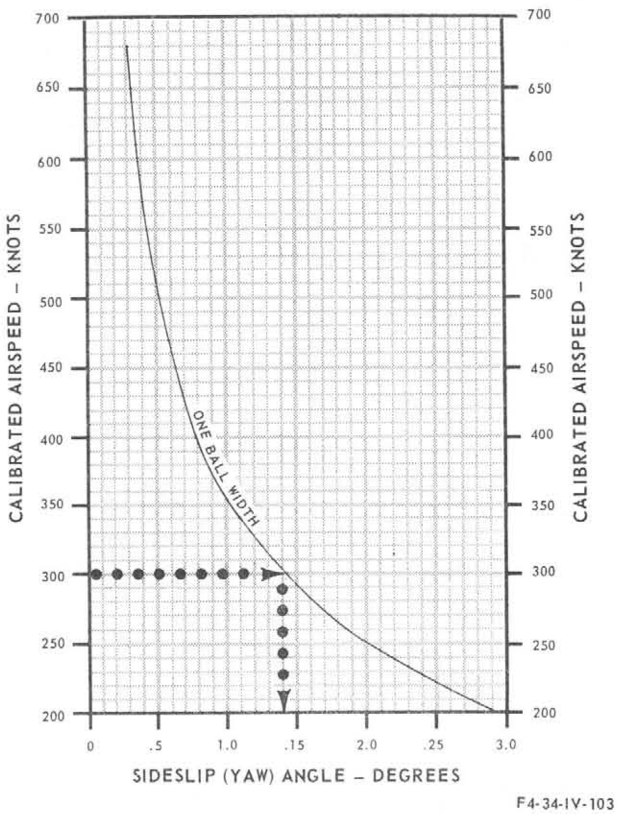


Figure 4-4

UNCOORDINATED FLIGHT

At release, the weapon follows the aircraft flight path direction with respect to the earth. Consequently, if the aircraft approaches the target in a skid, and releases the weapon with the tracking index on the target, the weapon will impact in the direction of the skid (along the flight path). Uncoordinated flight is reflected on the turn and bank indicator by a displacement of the ball. The following chart, figure 4-4 based on flight test data, provides data on side slip angle (degrees per ball-width) vs KCAS.

Enter the chart with release indicated airspeed, proceed horizontally until the curve is intersected, and project downward to the margin. The figure indicates the degrees of side slip angle per ball width at a given CAS, i.e., at 350 knots, one ball width deflection equals 1° of yaw.

The approximate error resulting from release in a skid would be the skid angle (in mils) times the release slant range divided by 1000. Thus, if the pilot releases at a 5000 ft range, in a 20 mil skid, the impact error should be 100 ft in the direction of the skid.

HARMONIZATION OF AIRCRAFT GUNS

The term "harmonization" refers to the procedure used to orient the optical sight tracking index, the radar, and gun armament with the F-4 aircraft. More specifically, the procedure involves the alignment of this equipment so that - when airborne - the tracking index (pipper) indicates the point of projectile impact. Harmonization methods for F-4D/E aircraft can be more involved than for F-4C aircraft. This is primarily due to the differences in reticle alignment procedures for the lead computing optical system (F-4D/E) and the fixed optical system of the F-4C. The optical alignment procedure for the F-4D/E can involve the complete removal of the sight. For the F-4C, alignment is accomplished in the cockpit. (See T.O. 1F-4C-2-18). With reticle alignment procedures complete, however, gun harmonization methods for any F-4 gun system are nearly the same.

Theoretically, all gun projectiles should follow the same flight path or trajectory and should strike a common point. However, certain factors cause different projectile trajectories, thus causing impacts in a defined area, rather than at a common point. This phenomenon is known as dispersion. Dispersion is caused by variations in manufacturing tolerances, barrel whip, changes in the statics and dynamics as the gun accelerates and decelerates, slight rate variations during steady-state firing, and variations in ammunition characteristics.

Harmonization of the aircraft is attained by orienting the guns to the optical sight through the use of harmonization targets. Basically, it is the alignment of three reference lines: the fuselage reference line, the sight line, and the timed barrel line. Two methods of harmonizing the F-4 aircraft are defined as the Boresight method and the Ground Fire method.

BORESIGHT METHOD

The boresight method is performed at either a 1000-inch or a 1000-foot range using a target designed specifically for these ranges. First, the aircraft is aligned with the target using a datum fixture and telescope assembly which is mounted to the nose gear well structure. Next, the optical sight is aligned to the target board using the sight pipper (F-4C) or an alignment telescope assembly (F-4D/E). (The lead computing sight unit is removed if the pipper is misaligned more than 50% in azimuth from a circle

on the target board. Then the sight mounting platform is aligned using a telescope assembly, and the sight unit is bench aligned. If pipper misalignment is less than 50%, the necessary adjustments may be accomplished in the cockpit.) The guns are then aligned to the target gun boresight point by using an offset boresight adapter and telescope assembly. The boresight adapter is mounted directly on the gun barrels, and the alignment is physically accomplished by gun azimuth and elevation adjustments.

Considering the gun pods, the boresight adapter is mounted to the barrels at the mid barrel clamp; the telescope is positioned out to the side of gun pod centerline. This arrangement is particularly advantageous for the CL pod since it precludes the necessity of having to raise the nose gear in order to sight the target. During the process of boresighting the CL gun pod on the 1000-inch target, an auxiliary boresight point may be located and marked on the nose gear door. This point may be used for a future quick, check of CL pod alignment without using a target.

Considering the F-4E nose gun, the mechanics of boresighting are basically the same as stated above. The difference is that the boresight adapter tool mounts directly into the firing barrel in the timed position. During the boresight alignment process on the target board, an auxiliary (back boresight) point may be located and marked on the aft fuselage section for future quick check purposes. The telescope assembly may be reversed in order to sight on the back boresight point.

Note

After nose gun firing operations, it has been observed that the gun vertical adjustment mechanism may become loose. Hence, load crews must check the mechanism tight during each gun loading operation. The mechanism may be tightened with no requirement for additional harmonization procedure.

GROUND FIRE METHOD

The ground fire method of harmonization can be accomplished on a 1000-inch range or ranges varying in length from 500 to 2250 feet. When this method is used, an aircraft tie-down pad and a firing-in butt are required. Prior to firing the guns, the aircraft must be jacked and established at a +2.0° attitude. Next, the optical sight and guns must be boresighted and the aircraft tied down. The nose landing gear must be raised for CL gun pod firing operations. The guns can then be fired and adjusted.

The ground fire procedure permits the guns to settle in their mounts, and to some extent, permits further control over factors affecting shot dispersion. The net result is more complete control over small errors that will be magnified in an actual firing situation. The method also checks gun operation and inspires crew confidence in the gun systems.

The harmonization procedure should be accomplished after uploading the pods, after a major aircraft inspection, after a barrel change or major gun component change, and after the sight unit has been removed. The AC will notice the need for harmonization when projectile impact is in obvious error. Also, the procedure should be conducted every 15 to 20 missions, or once a week during extensive gunnery operations.

PARALLEL vs. CONVERGED FIRE

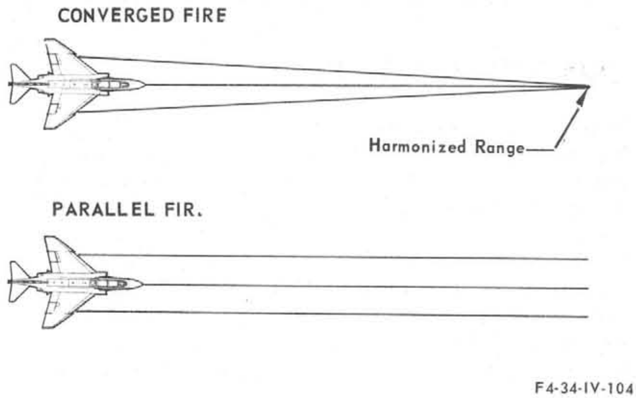


Figure 4-5

CONVERGED VS. PARALLEL FIRE

With the multiple gun firing stations available, possible methods of harmonization include either the convergent or the parallel methods (figure 4-5). For F-4 aircraft, the convergent method is used to provide the maximum consistent projectile density of the rounds fired. The specified density for acceptable harmonization of the gun pods is eighty percent of the rounds fired impacting in an 8-mil cone (18 feet at 2250 feet). The cones of dispersion for the gun pods are illustrated in section I, part 4 of this manual. The specified density for the nose gun is eighty percent of rounds fired in a 10 mil cone (22.5 feet at 2250 feet).

PARALLAX ERROR

The term parallax, where the deployment of aircraft weapons is involved, may be defined as the displacement or separation between the optical sight reticle and the point at which the specific armament is suspended (the timed barrel in the case of guns). A parallax sighting error results from this separation, and any correction applied must be accomplished in terms of the vertical parallax component and the horizontal component. The average vertical parallax component is 7.0 feet; the average horizontal component is 18.0 feet. These dimensions must be considered whenever sight depression charts are developed for the air-to-ground deployment of any armament using the optical sight as an aiming reference. The correction, which is applied in terms of mils, is included in sight depression charts in this manual.

WRCS OPERATIONAL ENVELOPE (DIVE TOSS MODE)

Operational envelopes that show WRCS Dive Toss delivery limitations are shown in figures 4-6 and 4-7. Figure 4-6 considers the computer system before T.O. 1F-4-702. Figure 4-7 dimensions consider the computer after T.O. 1F-4-702, which removes several operational restrictions imposed by the figure 4-6 computer. Figure 4-7 is therefore considered self-explanatory and the following discussion largely applies to the computer system of figure 4-6.

COMPUTER ACCURACY

In figure 4-6, two envelopes are shown to illustrate the boundary limits that determine the guaranteed computer accuracy; one for ± 150-foot computer accuracy, the other for ± 300-foot computer accuracy. The ± 150-foot accuracy envelope is bordered by 10-degree and 45° dive angles and 10,000 feet maximum slant range at pickle. The ± 3000-foot accuracy envelope is bordered by 10° and 60° dive angles and 20,000 feet maximum slant range at pickle (excluding the ± 150-foot accuracy envelope).

MAXIMUM RELEASE ALTITUDE

The 5000-foot maximum release altitude (above target) limitation resulted out of a modification to prevent an inadvertent bomb release when the pickle signal occurred at slant ranges greater than 20,000 feet. If the aircraft is not below the 5000-foot maximum release altitude when bomb release occurs; (1) bomb impact will be long of the target since the computer will establish the release point based on a release altitude of 5000 feet above target regardless of the actual release altitude, or (2) the bomb release solution may not occur and the bomb will not be released. This restriction is removed by T.O. 1F-4-702 (figure 4-7).

MAXIMUM PULL-OUT ALTITUDE (PICKLE ALT)

The maximum pullout altitude limitation curves (figure 4-6) show the conditions at the time of pickle (bomb release button depressed) that will place the aircraft less than 5000 feet above target at the time when automatic bomb release occurs, assuming that the pullout maneuver is initiated immediately after pickle. The curves are typical for the MK 83 or M117 GP bomb, an airspeed of 480 KTAS at the time of pickle, and assume that the selected G acceleration is obtained 2 seconds after pickle. The curves would be lower in altitude if an airspeed lower than 480 KTAS is used or if the G acceleration rate is increased. This is true because the altitude lost during pullout would be less and the bomb release angle would be greater. If the bomb is released above 5000 feet, the computer solves the ballistic equation based upon a 5000-foot release altitude and the impact will assume the corresponding altitude error. Refer to maximum release altitude above target curve description.

MINIMUM PULL-OUT ALTITUDE

The minimum pullout altitude curves (figures 4-6 and 4-7) are established for fuze arming requirements, fragmentation avoidance, and terrain avoidance. The fragmentation and fuze arming curves assume bomb button depressed at the time of pullout initiation. All curves are based on 480 knots TAS and 4.0-G pullout acceleration. Aircraft ground clearance is assumed to be 500 feet for dive angles of 30° and below, and 1000 feet for dive angles of 35° and above.

10-DEGREE CLIMB ANGLE

The accuracy of the computer is not guaranteed when bomb release occurs at aircraft climb angles greater than 10°. The curve (figures 4-6 and 4-7) illustrates that for the range of the MK 82 and M117 GP bomb, the altitude/range conditions of the aircraft at pickle must be above the curve to obtain a bomb release prior to reaching a 10° climb release angle. The curve assumes a 4.0-G pullout initiated immediately after pickle. The curve would be lower in altitude and greater in range for a lower pullout acceleration.

DIVE TOSS OPERATIONAL ENVELOPE | F-4D

PRIOR TO T.O. 1F-4-702

- AN/ASQ-91 Mod 3 Weapon Release Computer System.
- BOMB: MK 83 LDGP or M117 GP.
- Airspeed at Pickle: 480 KTAS
- Minimum Recovery Altitude: 30° and below = 500 ft; 35° and Above = 1000 ft.
- Minimum 4.0G Pullout Altitude (Pickle Alt) for:
  - a. MK 83 LDGP Bomb Fuze Arming, M904 Fuze with 4-sec Arm Delay Selected.
  - b. MK83 LDGP Bomb Fragment Clearance.

Notes

Pullout altitude is the altitude where the pullout maneuver is initiated. Pickle altitude is the altitude where the bomb release button is depressed and the pullout maneuver is initiated.

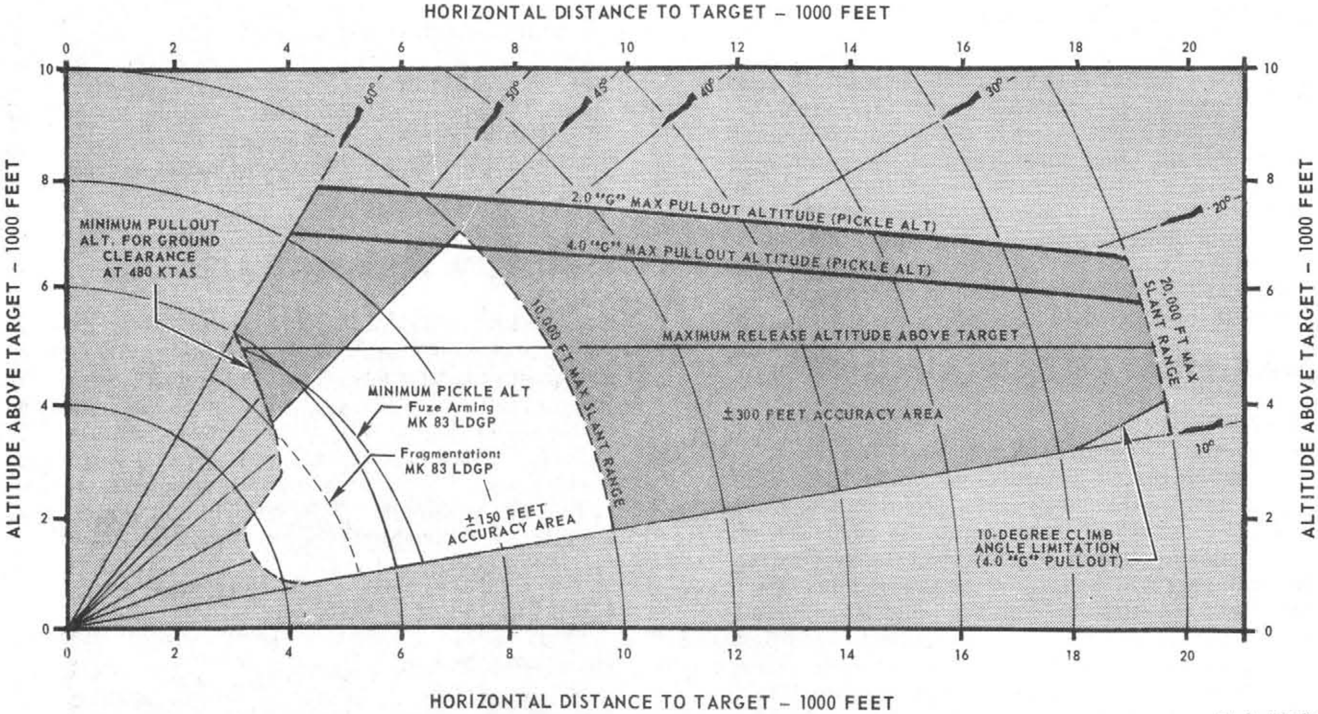
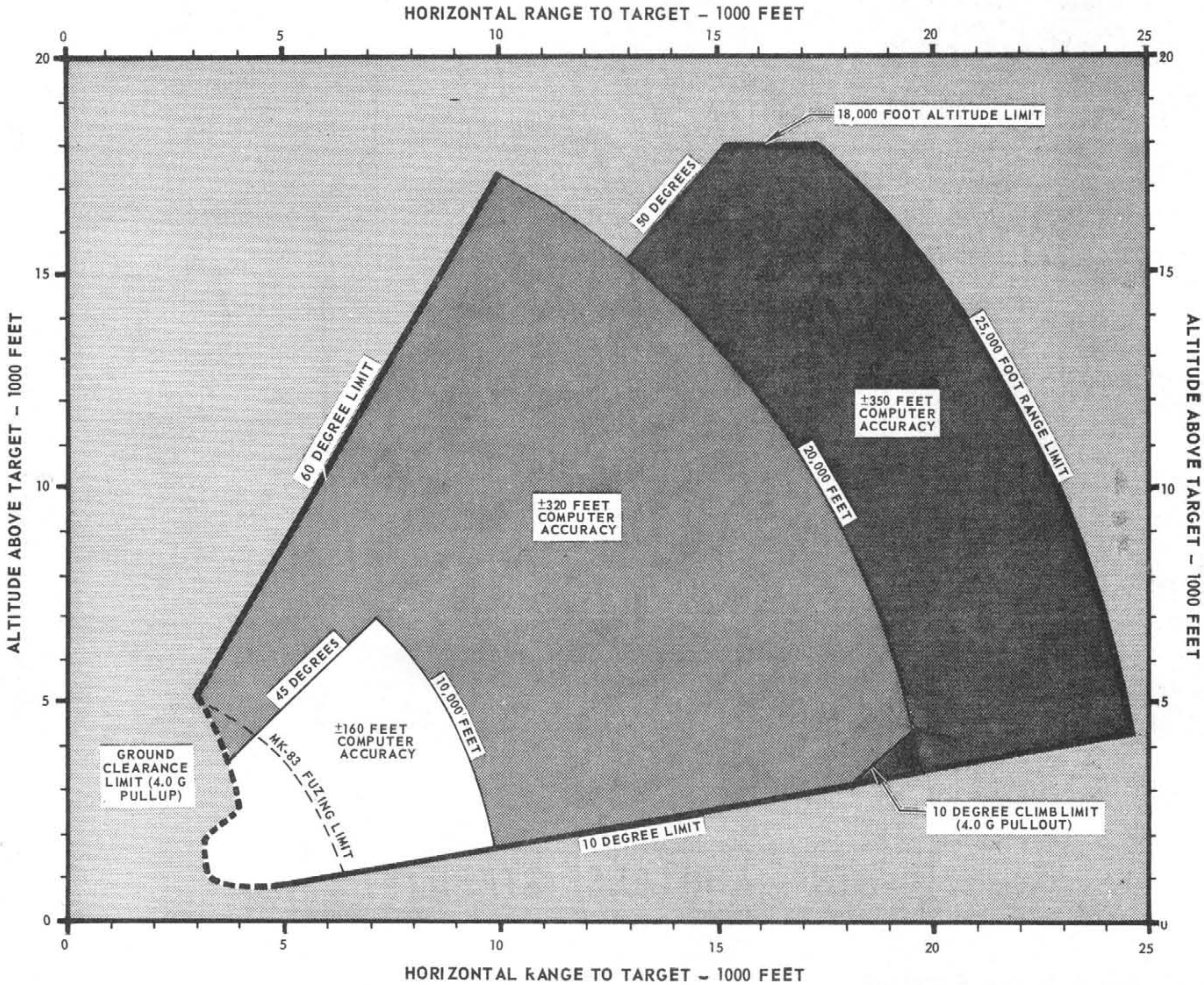


Figure 4-6

DIVE TOSS OPERATIONAL ENVELOPE F-4D F-4E

F-4D AFTER T.O. 1F-4-702 AND ALL F-4E



- OUTER LIMITS ARE BASE ON COMPUTER OPTIMUM OPERATIONAL CAPABILITIES WITH INCORPORATION OF T.O. 1F-4-702.
- ACCURACY BOUNDRIES DEFINE EXPECTED COMPUTER ACCURACY ASSUMING OTHER INPUT SYSTEMS PERFORM AS SPECIFIED.
- ALL BOUNDRIES ARE BASED ON AIRCRAFT POSITION AT TIME OF PICKLE.
- FUZING AND GROUND CLEARANCE LIMITS BASED ON 4.0G PULLUP ATTAINED IN 2.0 SECONDS, 480 KNOTS TAS.
- M-904 NOSE FUZE ASSUMED FOR MK-83 BOMB.

F4-34-IV-106

Figure 4-7

CTU-1/A RESUPPLY CONTAINER

CENTER OF GRAVITY RANGE

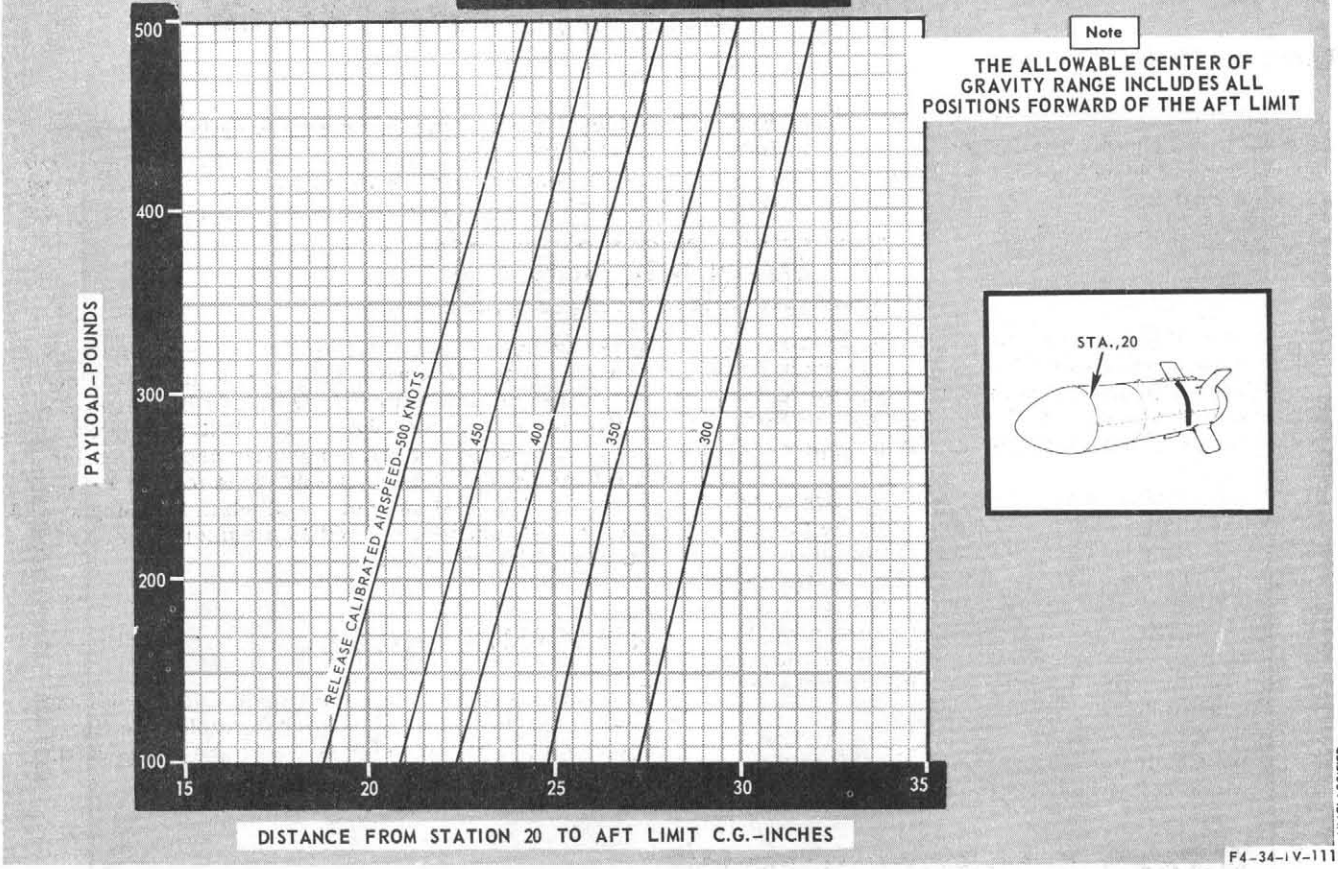


Figure 4-8

CTU-1/A RELEASE STABILITY

ALLOWABLE CG RANGE

The chart in figure 4-8 is provided to establish a limit CTU-1/A CG in order to verify container stability at release. The chart locates the most aft allowable CG position as a function of container payload weight and release calibrated airspeed. The measurement is expressed as the distance between the leading edge of the center section (station 20) and the most aft center of gravity (figure 4-8). The allowable CG therefore includes any point forward of the aft limit. Enter the chart with the planned payload weight, project to the planned release calibrated airspeed, and down to read the aft limit. The actual CG must be forward of this point.

CAUTION

If the actual CG is aft of the chart measurement, then the release speed and/or payload weight must be adjusted to establish an acceptable CG position. Failure to observe the required CG limits can result in unstable separation characteristics.

SECTION V PLANNING PROCEDURES and SAMPLE PROBLEMS

TABLE OF CONTENTS

INTRODUCTION

The purpose of this section is to provide the aircrew with the data required to plan a weapon delivery mission with the non-nuclear bombs and rockets, and the practice bombs used with the SUU-20/A or SUU-21/A dispenser, and illustrate the planning procedure.

The ballistic tables in T.O. 1F-4C-34-1-2 are based on the ICAO standard day conditions with the target at sea level. Ambient pressure and temperature variations from the standard day are considered to have negligible effect on trajectory accuracy. This assumption is valid for most non-nuclear weapon delivery conditions because the weapon time of flight is generally small. The loft ballistic tables are based on density altitude.

The Weapons Release Computer Set (WRCS) in the F-4D/E aircraft has reduced the mission planning procedures considerably, depending on the delivery mode selected; however, safe escape from fragmentation and ground clearance is always the responsibility of the aircrew. When the DIRECT delivery mode is selected, mission planning procedures for the F-4D/E aircraft are the same as for the F-4C aircraft. The last page of the Mission Planning Form (figure 6-1) outlines the WRCS parameter for the various delivery modes.

REFERENCE LINES

The various reference lines used in this manual are illustrated in figure 5-1. Other possible identifications of a particular reference line are also stated.

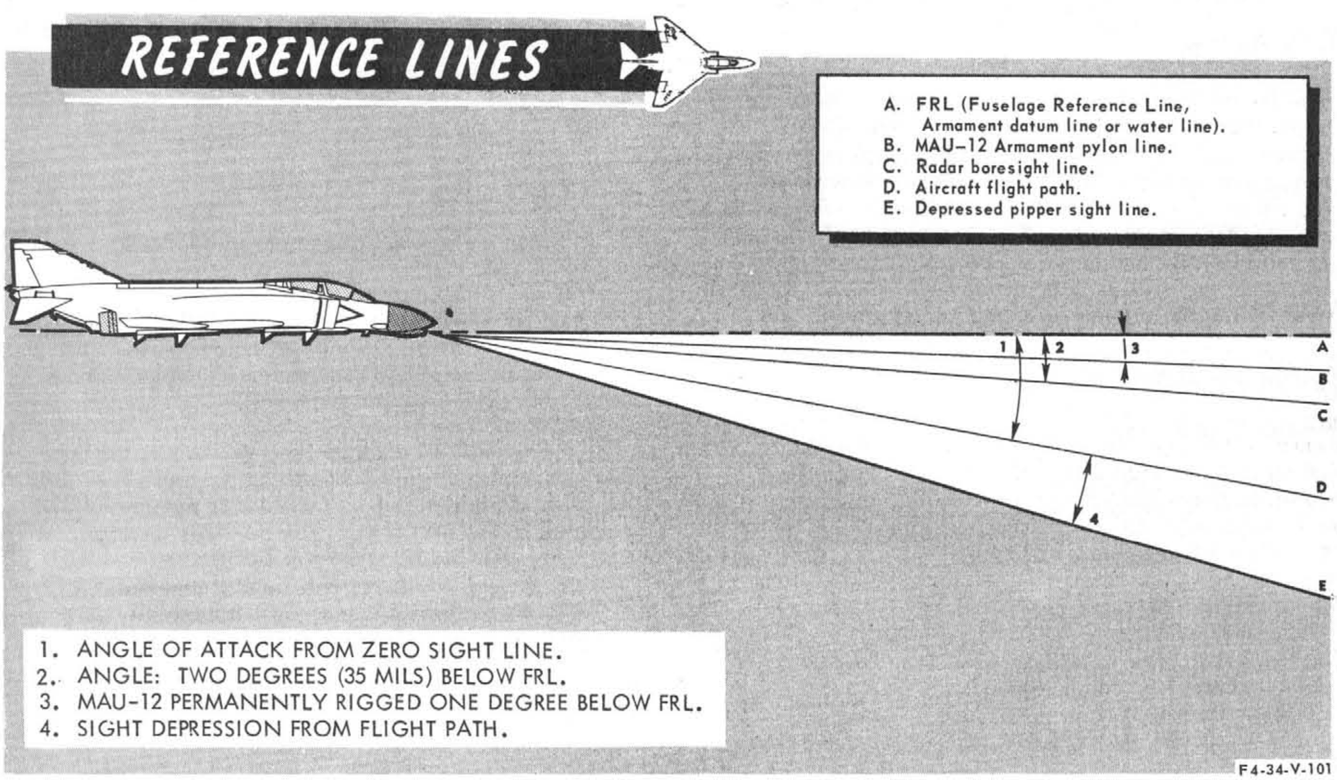


Figure 5-1

PRESSURE ALTITUDE

Pressure altitude is the altitude measured from standard sea level pressure, 29.92 inches of mercury (Hg). Pressure altitude is also the altitude read on the altimeter when set on 29.92 in. Hg. Target pressure altitude, used in mission planning, is obtained from the weather forecaster or based on the prevailing pressure altitude.

Target pressure altitude can be computed if the altimeter settings for the target area is known. Subtract 29.92 from the altimeter setting and apply the standard lapse rate (0.10 in. Hg. = 100 feet) to the pressure difference. If the altimeter setting is higher than 29.92, subtract the altitude difference from target elevation (MSL). If the reported altimeter setting is lower than 29.92, add the altitude difference to the target elevation (MSL).

Example:	Altimeter setting (-H, +L)	-30.62 in. Hg
	Standard datum plane:	29.92 in. Hg
	Pressure difference:	- 0.70 in. Hg
	Lapse Rate (100 ft/0.10 in.) = -700 ft.	
	Release altitude (MSL):	4000 feet
	Altitude difference:	-700 feet
	Release pressure altitude:	3300 feet

Note

If release pressure altitude is not known, release altitude MSL may be used (i.e. release altitude AGL, plus target elevation MSL).

D VALUE

The D (difference) value is the difference between true altitude and pressure altitude. The weather forecaster will provide the current D value for the requested altitude. The D value changes with altitude since ambient conditions seldom correspond to the standard lapse rate. The D value should be used to establish the indicated approach altitude and to establish the altitude set into the WRCS ALT RANGE control for the offset bomb and target find modes.

USING THE D VALUE

Mission Conditions

a. Approach Altitude AGL	1000 ft
b. Target Elevation MSL	2000 ft
c. Target Surface Altimeter Setting	30.02
d. Approach Altitude D Value	+250 ft

ALT RANGE CONTROL SETTING

a. Target Elevation MSL	2000 ft
b. Approach Altitude D Value (Reverse Sign)	-250 ft
c. ALT RANGE Control Setting	1750 ft

Note

When the D Value is not available, set the ALT RANGE control with the IP or target pressure altitude. When there is a significant difference between the radar IP and target elevation, also establish the ALT RANGE setting for the radar IP.

Indicated Altitude When Flying 29.92

a. Approach Altitude MSL	3000 ft
b. Approach Altitude D Value (Reverse Sign)	-250 ft
c. Indicated Approach Altitude	2750 ft

Indicated Altitude When Flying Surface Altimeter

a. Surface Altimeter Setting (-H, +L)	-30.02
b. Standard Datum Plane	29.92
c. Pressure Difference inches Hg	-0.10
d. Multiply by	x 1000
e. Pressure difference in feet	-100 ft
f. Approach Altitude MSL	3000 ft
g. Approach Altitude D Value (Reverse Sign)	-250 ft
h. Pressure difference in feet (Reverse Sign)	+100 ft
i. Indicated Approach Altitude	2850 ft

IMPACT PATTERN FOR RIPPLE RELEASE

The length of the impact pattern for a ripple release can be determined from the following formula:

$$P.L. = \left[(I_R)\,(1.69)\,(V_R)\,(\cos \theta)\,(N-1) \right] - \Delta R$$

P.L. = Pattern length in feet.

I_R = Release interval in sec.

V_R = Release TAS in knots.

θ = Release dive angle in degrees

N-1 = Number of bombs in ripple, minus one bomb.

Δ R = Difference in feet between range of first and last bombs released during the ripple sequence.

1.69 = The constant used to convert knots to feet per second. (If V_R is in fps, 1.69 must not be included in the formula.)

Note

Δ R is zero for level releases at constant TAS. For dive releases, interpolation in the tables will be required to determine Δ R. The release altitude for the last bomb in the ripple will be $(I_R)\,(1.69)\,(V_R)\,(\sin \theta)\,(N-1)$ feet lower than the first bomb release altitude.

For example, assume a six-bomb M117 ripple release, at 0.14-second intervals, released at 480 knots TAS, in a 30° dive, from 2500 feet AGL. Using (I_R) (1.69) (V_R) (Sin Δ) (N-1), the last bomb in the ripple will be 284 feet lower than the first bomb. Therefore, the release altitude of the last bomb will be 2216 feet AGL. Select the proper bombing table (T.O. 1F-4C-34-1-2) for the planned 30° dive, 2500 feet AGL, 480 knots TAS release condition and obtain the range of the first bomb in the ripple, 3538 feet. Using the same table, interpolate at the release altitude of the last bomb, 2216 feet, to obtain the range of the last bomb in the ripple, 3186 feet. The difference in feet between these two ranges will provide the Δ R in the pattern length computation, 352 feet.

ΔR = 3538 feet - 3186 ft. = 352 ft.

P.L. = 0.14 (480 kts 1.68) Cos 30 (6-1) -352 ft.

P.L. = 140 feet

SIGHT SETTING COMPUTATION

The bombing tables provide the sight depression angle from flight path. Use the angle of attack chart to find the aircraft angle of attack in mils. Angle of attack, plus sight depression angle from flight path, equals the optical sight setting for zero wind.

Wind correction can be applied to the sight setting or wind correction can be made by estimating an upwind aimpoint. The tables provide the data required for both methods of wind correction. The mil correction is added for headwind and subtracted for tailwind.

INTERPOLATION OF BALLISTIC TABLES

When it is deemed necessary to interpolate the ballistic tables, the following review may be helpful. Assume that the sight depression is to be interpolated for 420 knots TAS:

$$\begin{array}{l} 400 \text{ knots} = 15.4 \text{ mils} \\ 450 \text{ knots} = \underline{13.7 \text{ mils}} \\ \qquad\qquad\quad\; 1.7 \text{ mils} \end{array}$$

$$\frac{(450 \text{ knots}) - (420 \text{ knots})}{(450 \text{ knots}) - (400 \text{ knots})} \times 1.7 \text{ mils}$$

$$\frac{30}{50} \times 1.7 = 01.02 \text{ mil}$$

$$1.02 + 13.7 = 14.72 \text{ mils}$$

420 knots = 14.7 mils

DESCRIPTION OF CHARTS AND TABLES

MISSION PLANNING FORM

The mission planning form (figure 6-1) provides a convenient sequence for planning a non-nuclear weapon delivery mission. The planning form is divided into seven parts. The first three parts (Mission Conditions, Release Conditions, and Wind Values) are applicable to all delivery modes. The remaining four parts (Dive and Low-Level Bombing Conditions, Rocket Launch and Gun Firing Conditions, Loft Bombing Ripple Release Conditions and WRCS Counter Settings) are applicable only to delivery mode implied.

DIVE RECOVERY CHARTS

The dive recovery charts (figure 6-2) are used to determine the altitude lost during pullout after bomb release. The charts are based on an acceleration of 3.0 G, 4.0 G, or 5.0 G obtained in 2 seconds after release. For conditions when C_L max is reached, the curves follow the buffet boundry. Enter the chart with release velocity TAS, project to the dive angle and across, to read altitude lost. Release altitude must be greater than the sum of altitude lost during pullout and minimum recovery altitude. This chart contains no reaction time and no safety factors.

Figure 6-2, sheet 4 presents the altitude lost during recovery when performing a 4.0 G pullup in a banked turn. The altitude lost for the following conditions is provided:

a. Dive angle: 15°, 30°, and 45°.
b. True airspeed when pullup is initiated.
c. Bank angle during the pullup: 0° (wings level pullup), 10°, 20°, 30°, and 45° turns.

Note

The pullup acceleration is assumed to be 4.0 G obtained in 2 seconds.

ANGLE OF ATTACK CHART

The angle of attack chart (figure 6-3) is used to determine the aircraft fuselage angle of attack. The purpose of the chart is to aid in computing the optical sight depression angle in mils. The unit of measurement used to calibrate the mil scale is: 1° = 17.45 mils, or 1 mil = 0.0573°. The zero sight setting (or sight line) is at the fuselage reference line. Enter the chart with the release calibrated airspeed, project to the aircraft gross weight at release, project to the preplanned dive angle, project right, and read the fuselage angle of attack in mils. To determine the optical sight setting, add the angle of attack to the sight depression from flight path obtained from the sight depression charts (figure 6-10) or the bombing tables.

Note

F-4D/E Aircraft. When the optical sight is pitch stabilized, angle of attack is not added to the sight depression from flight path. The sight is pitch stabilized in all LABS modes and in the WRCS LAYDOWN mode. When the optical sight is pitch stabilized, the maximum usable sight setting is a function of angle of attack and transit changes in pitch attitude. For example, with an angle of attack of 60 mils, the max setting is (245-60) 185 mils minus anticipated changes in pitch attitude. Also, during the pullup portion in a loft maneuver, the sight reticle will not be visible above 20°.

AIRSPEED CONVERSION CHART

The airspeed conversion chart (figure 6-4) presents the relationship of calibrated airspeed (CAS), true airspeed (TAS), and true Mach number as a function of free-air temperature (outside air temperature) in degrees centigrade, and true pressure altitude. If true pressure altitude at release altitude (or at approach altitude for loft bombing) is not available, the release altitude above mean sea level (MSL) may be used.

Note

For the F-4E, indicated airspeed and calibrated airspeed are considered to be equal; position error correction is not required.

ALTITUDE CONVERSION CHART

The altitude conversion chart (figure 6-5) is used to determine the density altitude for a given pressure altitude (or altimeter setting) and temperature. The loft ballistic tables, the rocket launch and gun firing tables in T.O. 1F-4C-34-1-2 are presented as a function of density altitude.

SIDE EJECTION IMPACT DISTANCE

The side ejection charts (figure 6-6) empirically show the expected impact dispersion due to MER/TER lateral ejection forces applied at release. The plots are based on the following factors:

a. An ejection velocity as a function of store weight.
b. A MER/TER ejection vector of 45° to the side.
c. Outboard MER canted 7.5° from vertical.
d. The distance of the inboard and outboard stations from the airplane centerline.

The error distance is shown with respect to the centerline of the aircraft and as a function of time from release to impact.

ALTIMETER POSITION ERROR

The table in figure 6-7 shows the expected altimeter position error for level flight weapon delivery conditions: The table is applicable to F-4C-24 thru 29 and F-4D-24 thru 29 after T.O. 1F-4-754. After T.O. 1F-4-754 (and all F-4E aircraft), the error becomes zero plus or minus whatever error is noted during preflight operations. The table is used in mission planning to establish the indicated weapon release altitude with static correction operating. Additional information is available in T.O. 1F-4C-1.

ALTIMETER LAG CHART

During a dive, the altimeter does not unwind at a rate equal to the actual rate of aircraft descent. The altimeter lag chart (figure 6-8) provides the altitude that should be added to obtain an indicated release altitude above ground level. Enter the chart with release velocity TAS, project to the dive angle, and down to read altimeter lag.

SINE AND COSINE TABLE

The sine and cosine table (figure 6-9) is used to compute the bomb impact pattern length for a ripple release, and to compute the release altitude of the last bomb.

SIGHT DEPRESSION CHART

The sight depression charts (figure 6-10) provide the sight angle in mils for a given release altitude AGL and horizontal distance from release to impact for dive angles from level flight, 5° dive thru 60° dive. Enter the chart with distance, project to the release altitude above target, and read the sight depression angle from flight path in mils. To compute the final sight setting, algebraically add the angle of attack from zero sight line and wind correction factors. Parallax correction factors are included in these charts. Parallax correction is necessary to compensate for the vertical and horizontal distance between the sight head and the bomb rack.

RELATIVE WIND VECTOR CHART

When forecast wind data are used for mission planning, the relative wind vector chart (figure 6-11) is used to obtain the rangewind and crosswind components. The wind velocity at release altitude should be used. The displacement of the bomb is a function of initial velocity and time of flight. As the time becomes less, the magnitude of deflection is also less. Use the relative wind vector chart as follows:

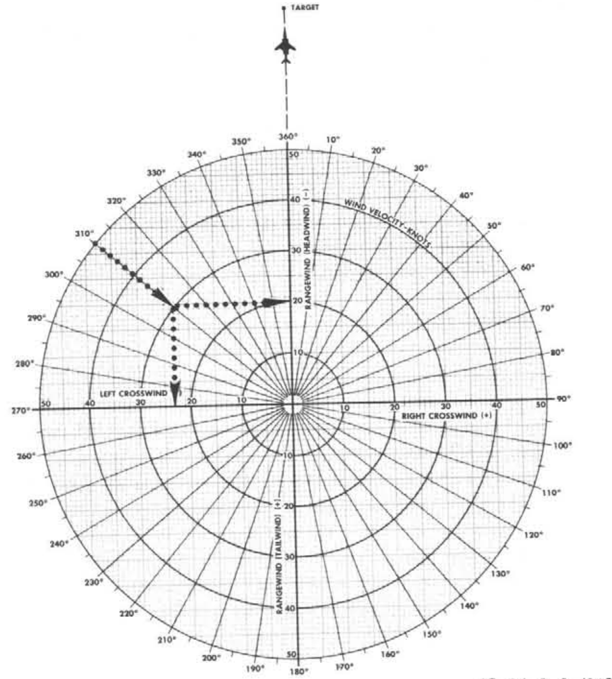
Given: a. Forecast wind velocity: 350°/30 knots.
b. Approach course to target: 040°.

Find: a. Relative wind direction: 310°.
b. Rangewind component: 20 knots headwind.
c. Crosswind component: 23 knots left.

Relative wind direction must be determined before entering the relative wind vector chart. Obtain relative wind direction by subtracting approach course to target, 040°, from forecast wing direction over target.

350° - 040° = 310° relative wind direction.

RELATIVE WIND VECTOR



4C-34-1-1-(165)

Figure 5-2

Note

If the aircraft course to target is greater than the wind direction, add 360° to the wind direction; then subtract aircraft course from the wind direction to obtain relative wind direction.

Enter the sample relative wind vector chart (figure 5-2) with 310°. Project to the 30-knot wind circle and over to the horizontal and the vertical axes: read the rangewind and crosswind components respectively.

WIND CORRECTION

OFFSET AIMPOINT

For level delivery of the high drag bombs (Snakeye I, CBU's), crosswind correction is usually achieved by crabbing the aircraft into the wind and offsetting the ground track in the upwind direction parallel to the no-wind course. Rangewind correction is accomplished by correcting the sight setting by releasing early or late. The equation for rangewind correction is as follows:

$$(\text{Rangewind in knots})\ (t_c)\ (1.69) = \text{correction in feet.}$$

When the aircraft is crabbed to maintain a ground track during the approach and release, the need for crosswind correction is reduced, as illustrated by the following equation which is valid for both high drag and low drag bombs.

$$(\text{Crosswind in knots})\left[(t_c)\ (1.69) - \frac{R_3}{V_A}\right]$$

When the aircraft is drifting (not crabbed), the rangewind and crosswind correction factors are the same:

$$(\text{Wind in knots})\ (t_c)\ (1.69) = \text{correction in feet}$$

where:

t_c = Bomb time of fall in seconds.
R_3 = Bomb range in feet.
V_A = Release velocity in knots TAS
1.69 = Conversion factor to change knots to feet per second.

For the low-altitude level delivery of the low drag bombs, crosswind correction is usually achieved by crabbing the airplane into the wind so that the aircraft ground track will pass through the target. The equation will show that an offset ground track is not required.

When the crabbing technique is used with a sight that is not drift stabilized, the pipper will not be directly on the target when release occurs; because of the crab angle, there will be an apparent increase in the sight angle. As the crab angle increases, the pipper scribes an imaginary arc through the target radiating from the release point. Therefore, the bomb should be released when the pipper is on the arc which will appear to be short of the target.

UP-WIND AIMPOINT

The up-wind aimpoint method of wind correction can be used for all delivery modes and all non-nuclear weapons. The total wind speed at release altitude is used to relocate the aimpoint up-wind from the target by an amount equal to the product of the total wind speed times the weapon time of fall. The up-wind aimpoint may be approached from any direction. The no-wind sight setting is used and the weapon is released at the planned release conditions. The aircraft is drifting, i.e., no attempt is made to correct the aircraft for drift by crabbing.

WIND CORRECTION - WRCS MODES (F-4D/E)

No corrections for the effects of wind should be required for the delivery of low drag bombs with the F-4D/E aircraft using the dive toss bombing mode. When using the dive laydown, laydown, or offset bombing mode, the low drag bomb should be released at a ground speed that is equal to the planned true airspeed range of the bomb and the aircraft should be crabbed to maintain a ground track through the target.

When high drag and medium drag bombs are released from altitudes of 100 feet or less with wind conditions less than 10 knots, wind effects produce errors of less than 50 feet. Higher altitudes or higher wind conditions can be tolerated (without wind corrections) when the ripple release mode is used to minimize range error; the flight path is offset in the upwind

direction. The equations for wind correction when the bomb is released at the planned true airspeed is:

(Rangewind in knots) (t_c) (1.69) = correction in feet.

(Crosswind in knots) (t_c) $\left(1.69 - \frac{R_3}{V_A}\right)$ = correction in feet.

DIVE ANGLE VS DISTANCE CHART

The dive angle vs distance chart (figure 6-12) provides a means to approximate the distance from target for a given dive angle and altitude and determine the slant range. Trajectory drop can also be computed. To determine the trajectory drop, place a mark on the chart at the intersection of release altitude and dive angle: project down and find distance. Subtract the bomb range from the distance to obtain the trajectory drop. This chart is provided as supplementary data and is not used in the sample problem.

FUZE ARMING AND SAFE ESCAPE

WARNING

- The lower release conditions provided in the ballistics tables in T.O. 1F-4C-34-1-2 must be checked with the Fuze Arming and Safe Escape tables (figures 6-13 thru 6-16) and the Dive Recovery charts (figure 6-2) in section VI of this manual to ensure a safe delivery condition.
- Refer to section I, part 4, for fuze description, operating restrictions, and arming tolerance. Refer to T.O. 1F-4C-1 for External Stores Limitations.

FUZE ARMING

Fuze arming is the vertical distance below the aircraft where the fuze will be unarmed. If bomb impact occurs within the fuze arming distance, a dud bomb is predicted.

WARNING

- When the MK 82 Snakeye I or M117 retarded bombs are configured for in-flight selection of high/low drag release, the minimum M904E2/E3 nose fuze setting is 6.0 seconds and the low drag bomb time flight must be greater than 6.6 seconds.
- If a 2-second nose fuze arming time is used and the bomb is release low-drag, the aircraft will be within the lethal fragment envelope when the fuze is armed.

Note

If the retarded bombs are configured to exclude cockpit selection of low drag delivery, a 2-second nose fuze arming delay setting may be used.

For the M904 and M905 fuzes, only the 4 and 6-second arming delay settings are considered for low drag bomb releases. Current tolerances listed for the arming delay times are ± 10 percent of the delay settings. The delay setting plus the positive tolerance was used in the determination of minimum release altitude, or vertical drop required for these fuzes to arm. For example, the 4-second arming delay setting will require a minimum bomb time of fall of 4.4 seconds. The 6-second arming delay setting requires a minimum time of fall of 6.6 seconds.

SAFE ESCAPE

Dive Delivery

Safe escape is the vertical distance above the ground that includes the fragment envelope. Safe escape is also the vertical distance above the ground where the pilot must initiate pullout to ensure a minimum ground clearance. Normally, the minimum ground clearance for dive angles of 30° and less is 500 feet; for dive angles of 35° and greater is 1000 feet. The minimum release altitude for aircraft ground clearance is based on a 4.0-G pullout and assumes that 4.0 G is obtained in 2 seconds after the last bomb release.

Level Delivery

The minimum release altitudes for the level release of retarded and freefall (unretarded) GP bombs are provided in the safe escape tables. Two escape maneuvers are provided: (1) 4.0-G MIL power pullout at release and (2) straight and level, constant speed recovery. The level release followed by a 4.0-G MIL power pullout is safe only for single bomb release. The G is maintained until a 20° to 30° climbout angle is attained. An alternate maneuver that may be used is accomplished by performing a 4.0-G banked turn using a 60° bank angle. The combination of bank angle and G-force will produce a climbing turn - not a level turn. The aircrew must consider fuze arming.

Rocket Launch

The Safe Escape Tables state the minimum launch altitudes above ground level required for safe escape from the fragments of the 2.75-inch FFAR with the MK 1 warhead and the M151 warhead. The minimum launch altitudes are based on a pullout acceleration of 4.0 G obtained in 2 seconds used to attain a 10° climb angle.

DETERMINATION OF MINIMUM ACCEPTABLE RELEASE ALTITUDE

The vertical drop to fuze arming, minimum recovery altitude, and bomb fragmentation envelope clearance must all be considered in the determination of the minimum acceptable release conditions. The altitude or vertical drop required for each of these parameters should be determined from the data listed in the safe escape and fuze arming tables. The greatest value is the minimum release altitude for the fuze, dive angle, and airspeed conditions being considered.

WARNING

- The aircrew must determine the minimum ground clearance.
- When the FMU-30/B fuze is used with the BLU-31/B land mine, minimum release altitudes which will provide safe escape from bomb fragments for instantaneous or contact bursts should be selected. This is required to protect the aircraft and aircrew in the event of a premature bomb detonation at initial impact. Refer to Safe Escape, figure 6-14.
- For BLU-31/B land mine shapes, the trajectory angle at impact should be in excess of 15° to preclude ricochet.

IMPACT VELOCITY TABLES

Impact striking velocity data for the BLU-31/B land mine is provided in T.O. 1F-4C-34-1-2. The tables provide the striking velocity of the weapon in feet per second for various dive angles, release true airspeeds, and release altitudes above target.

FUZE SAFE ARMING TIME REQUIRED

The objective of the following discussion is two-fold:

a. Point out the wide variation in required safe escape distances and safe fuze arming times for the various release conditions, release modes, and escape maneuvers.

b. Emphasize the importance of a judicious selection of fuze safe arming times during mission planning where VT or impact fuzes are involved. The fuze arming times, which are required to assure safe escape from premature airbursts (or earlier-than-intended impact bursts), vary widely as a function of release conditions (level or dive, low altitude or high altitude) and release modes (single, pairs, salvo, or timed ripple). The required safe arming times provided in figure 6-16 for various GP bombs are listed as a function of release conditions and escape maneuvers. For clarity, an illustration of the delivery and escape maneuver profile for each type of release and escape maneuver is also presented.

DETERMINATION OF FUZE SAFE ARMING TIMES

VT Fuzed Munitions

When using proximity fuzes with GP bombs, safety considerations require that the fuzes be kept unarmed until the releasing aircraft has attained an adequate distance from the munition to assure safe escape.

WARNING

Observance of this safety consideration is absolutely mandatory to assure that the delivery aircraft will not be hit by lethal fragments from its own munition in the event of a premature detonation at the expiration of the fuze arming time.

In the determination of the VT fuze safe arming time setting, the value selected should be equal to or greater than the required safe arming time value shown in the table for the desired release condition, release mode, and escape maneuver.

Impact Fuzed Munitions

Ordinarily, premature airburst detonations of impact fuzed munitions are not anticipated. However, to protect the aircraft and aircrew from any earlier-than-intended burst, fuze safe arming time settings, which will assure safe escape, should be employed with impact type fuzes (as well as VT fuzes) whenever operational considerations will permit this course of action. Use of this procedure would help protect the aircraft and aircrew in the event of an inadvertent low altitude release as well as any premature airburst.

WARNING

If operational considerations and the range of available fuze arming time settings require the selection of settings which will not assure safe escape from an earlier-than-intended burst, the aircrew should be briefed to carefully observe the appropriate minimum release altitudes and recovery maneuvers required for safe escape.

As an additional safety precaution, whenever operational considerations require the use of fuze arming time settings which will not assure safe escape from a premature burst, the aircrew should be briefed to execute a 4.0 G pullup or banked turn escape maneuver immediately after release.

WRCS DRAG COEFFICIENTS (CB)

The drag coefficient entered in the WRCS control panel for the dive toss delivery mode (F-4D/E aircraft) is listed in figure 6-17. The drag coefficient (C_B) is a bias factor that is analytically established to equate the computer bomb trajectory to the actual bomb trajectory. This drag coefficient value is not the mathematical drag coefficient of the bomb. The drag coefficient values and bias settings are provided in figure 6-17. The ground crew must set the Ballistic Computer (CP805/ASQ-91) located in door 19. When V_e is changed, the drag coefficient will change. Each drag coefficient is optimized for the conditions listed.

Figure 6-17 presents the drag coefficients for the CBU-24, -29 series Dispenser and Bomb. These C_B values are presented as a function of the following parameters:

a. Pullup acceleration: 3.0 G, 4.0 G, 5.0 G and 6.0 G. This data assumes that the pullup is initiated immediately after pickle and that the pullup G is attained 2 seconds after pickle.
b. Dive angle: 15°, 30° and 45°.
c. Slant range at time of pickle: 20,000 ft, 15,000 ft. and 10,000 feet.

EXPOSURE TIME CHART

DIVE BOMBING

The exposure time chart for dive bombing (figure 6-18) provides the time in seconds that the aircraft will be below a given altitude for a 45° dive delivery followed by a 4 or 5 G pullout to a 30° climb.

LOFT BOMBING

The exposure time chart for loft bombing (figure 6-18) is provided as an aid to mission planning, for a loft bomb delivery, in determining tactics required in a defended area. The time that the aircraft is exposed above various altitudes is given in seconds. The chart is computed for a 300-foot approach altitude AGL; for altitudes other than 300 feet, add the difference to the exposure time altitude given on the chart.

LOFT BOMBING WIND CORRECTION

The loft bombing wind correction chart (figure 6-19) is used to correct the pullup timer setting for rangewind (headwind or tailwind) and for the wind effect on the $R_2 + R_3$ range (range from pullup to bomb impact). The sample problem illustrates the use of this chart.

WRCS BALLISTIC DATA (F-4D/E)

The WRCS ballistics data for the dive toss bombing mode 3, 6, 8, and 12-bomb ripple release, and for GP bombs, are presented in figure 6-20. Dive Toss Bombing data for the MK 20 Mod 0 Rockeye II is presented in figure 6-21. For WRCS ballistic data for the CBU-24, -29, -49 Dispenser and Bomb, refer to T.O. 1F-4C-34-1-1A, section VI.

The WRCS ballistic data is presented as a function of the following parameters:

a. Pullout acceleration: 2.0 G, 3.0 G, and 4.0 G obtain 2 seconds after pickle.

Note

The ballistic data is based on the assumption that the pullup maneuver is initiated immediately after pickle and that the pullup G is attained 2 seconds after pickle.

b. Release interval: 0.06, 0.10, and 0.14 second.
c. True airspeed at time of pickle: 450, 500, 550, and 600 knots.
d. Dive angle at time of pickle: 20°, 30°, and 45°.
e. Slant range at time of pickle: 10,000 ft, 15,000 ft, and 20,000 ft.

The following data is obtained from the tables:

a. Altitude above target at the time of pickle is computed as a function of the dive angle and slant range.

Note

The following data is presented for the middle bomb in ripple release.

b. The time from pickle to middle bomb release in seconds.
c. The release altitude of the middle bomb in feet.
d. The release angle of the middle bomb in degrees, measured from horizontal (0°) where negative is below the local horizontal.
e. The time of fall from release to impact of the middle bomb.
f. The pattern length of 3, 6, 8 and 12-bomb ripple release. To approximate the pattern length for less than an eight-bomb ripple, divide the eight-bomb stick length (S) by seven (S/7), and then multiply by the number of bombs, minus one bomb, to be released (N-1).

BLU-66/B (CBU-46/A) LEFT DEFLECTION

The characteristic of the BLU-66/B bomb causes the trajectory to shift to the left at an approximate 6:1 ratio. Refer to figure 6-22.

BLU-45/B (CBU-33/A) IMPACT LATERAL DISPLACEMENT

When the CBU-33/A is carried on the shoulder positions of either MER or TER, the BLU-45/B impact pattern will be displaced laterally in the direction of the side ejection. The magnitude of this lateral displacement, which is induced by an effective lateral munition ejection velocity component of approximately 14 ft/sec (20 x sin 45°), is indicated in figure 4-23. The quantities listed are measured from the point of ejection and cover the range of release conditions provided in the CBU-33/A bombing tables in T.O. 1F-4C-34-1-2.

BLU-49/B (CBU-38/A) IMPACT LATERAL DISPLACEMENT

When the CBU-38/A is carried on the shoulder positions of either MERs or TERs, the BLU-49/B impact pattern will be displayed laterally in the direction of the side ejection. The magnitude of this lateral displacement in feet is induced by an effective lateral munition ejection velocity component of approximately 44 ft/sec (62 x sin 45°), as indicated in figure 6-24. The lateral displacement distances listed are measured from the point of ejection and include the release conditions provided in the CBU-38/A bombing tables in T.O. 1F-4C-34-1-2.

BOMBING TABLES

Note

The bombing tables (ballistic tables) are contained in T.O. 1F-4C-34-1-2. Classified ballistic tables are presented in T.O. 1F-4C-34-1-2A. Following the table of contents in section VI of this manual is a list of all tables contained in the dash-two manuals.

WARNING

The aircrew must establish the minimum release altitude for safe escape and terrain avoidance.

SINGLE BOMB RELEASE

The following data can be obtained from the bombing tables for a specific release true airspeed, release altitude above target and dive angle:

a. Bomb range in feet.
b. Time of flight of the bomb in seconds.
c. Slant range from release to bomb impact in seconds.
d. Bomb impact angle in degrees.
e. Sight depression from flight path in mils. (Fuselage angle of attack must be added to obtain the optical sight depression except when the sight is pitch stabilized.)
f. Wind correction factors: headwind and tailwind in mils per knot of wind: and crosswind for a drifting aircraft and/or a crabbing aircraft (level release in feet per knot of wind). Refer to Wind Correction for a description of wind factor application.

Note

For the CBU-1, -2 weapons, the bombing tables provide a sight depression angle that will place the impact of the first bomblet 500 feet short of the target.

For CBU-24, -29, -49, -52 and -58 series dispenser and bomb, single release; level and dive delivery, refer to T.O. 1F-4C-34-1-2 where the above data plus the following data is available.

a. Fuze function time in seconds after release for a given fuze function altitude.
b. Impact pattern diameter in feet.

Note

The bomb range and the sight depression from flight path values are established from the center of the impact pattern of one dispenser.

RIPPLE RELEASE

Ripple release tables are provided for the following bombs:

a. M117 GP Bomb.
b. MK 82 LDGP Bomb.
c. MD 83 LDGP Bomb.
d. MK 82 Snakeye Bomb (High Drag)

The following data can be obtained from the ripple release tables for a specific release true airspeed dive angle, first bomb release altitude above target, release intervalometer setting, and number of bombs released:

a. Range from first bomb released to the center of the impact pattern in feet.
b. Time of fall of the first bomb in seconds.
c. Release altitude of the last bomb in feet.
d. Pattern length in feet.
e. Sight depression from flight path measured from the release altitude of the first bomb to the center of the impact pattern in mils.
f. Wind Correction factors: headwind and tailwind in mils per knot of wind; and crosswind for a drifting aircraft and/or for a crabbing aircraft (e.g. MK 82 Snakeye I level delivery) in feet per knot of wind. Refer to Wind Correction for a description of wind factor application.

LEVEL BOMBING TABLE (LEAFLET BOMB)

The level bombing table is completed for the M129E1 leaflet bomb. A sample problem is not provided for this delivery mode. The bombing table provides the bomb range and time of flight for a 3000-foot burst when released from 4000 feet thru 11,000 feet (in 1000-foot increments) and released at true airspeeds of 360 knots thru 560 knots in 20-knot increments.

To determine the bomb range and time of flight for burst heights other than 3000 feet, determine the release-to-burst distance. Then, from the bombing table, select a release altitude that will provide the same release-to-burst distance (release altitude, minus 3000 feet burst height, equals release-to-burst distance). For example:

a. Desired release altitude: 4000 feet.
b. Desired burst height: 1000 feet.
c. Release-to-burst distance: 3000 feet.
4000 ft. minus 1000 ft. = 3000 ft.
d. Obtain the bomb range and time of flight from the 6000-foot release altitude column.
6000 ft. minus 3000 ft. = 3000 ft.

Bomb Release Conditions

The level bombing table includes the following parameters:

a. Burst height above target: 3000 feet.
b. Level release velocity TAS: 360 knots thru 560 knots.
c. Release altitude above target: 4000 feet thru 11,000 feet.

The following data are obtained from the level bombing table:

a. Bomb range from release to burst, in feet.
b. Bomb time of flight from release to burst, in seconds.

LOFT BOMBING TABLES

GP Bombs, BDU-33/B, A/B, B/B

The loft bombing tables include the following parameters:

a. Target density altitude: -4000 ft., -2000 ft., zero ft., 2000 ft., 4000 ft., 6000 ft., and 8000 ft.
b. Power Setting: full military power selected at pullup.
c. Aircraft gross weight at pullup: 42,000 and 48,000 pounds, or 36,000 and 42,000 pounds.
d. Release angle: 20° thru 50° in 2° increments.
e. Approach altitude AGL: 300 ft., 1000 ft., 3000 ft., and 5000 ft.
f. Approach true airspeed: 500, 550, and 600 knots.
g. Pullup acceleration: 4 G obtained in 2 seconds.

The following data are obtained from the tables:

a. Release altitude above target in feet.
b. Time from pullup to release in seconds.
c. Low angle release gyro setting in degrees.
d. Range from pullup to bomb impact in feet.
e. Time from bomb release to bomb impact in seconds.

CBU-24, -29, -49, -52, and 58 Series Dispensers and Bombs

Note

The level and dive bombing tables for the CBU-24, -29, -49, -52 and -58 are contained in T.O. 1F-4C-34-1-2.

The loft bombing tables include the following parameters and are contained in T.O. 1F-4C-34-1-2.

a. Target density altitude: -4000 ft, -2000 ft, zero ft., 2000 ft., 4000 ft., 6000 ft., and 8000 ft.
b. Power setting: Full military power selected at pullup.
c. Aircraft gross weight at pullup: 42,000 pounds and 48,000 pounds.
d. Release angle: 30° and 40°.
e. Approach altitude AGL: 300; 1000; 3000; and 5000 feet.
f. Approach true airspeed: 500, 550 and 600 knots.
g. Pullup acceleration 4.0 G obtained in 2 seconds.
h. Ripple release intervals: 100 and 140 milliseconds.
i. Number of bombs released: eight.
j. Fuze function altitude: 2500 feet AGL.
k. Weapon: CBU-24, -29, -49 series.

The following data are obtained from the tables:

a. The release attitude of the first bomb in degrees is the value that is set in the low angle release gyro. The time from pullup to release value on the following line is increased by the ripple interval time used, and the resulting release angle is provided on the same line. Eight lines are provided for each release condition; one line for each bomb ripple off. If less than eight bombs are to be released, use the corresponding time from pullup to release. Establish the following parameter of the first and last bomb off:
b. Release altitude above target in feet AGL.
c. Time from pullup to release in seconds.
d. Fuze function time setting required to obtain a 2500-foot fuze function altitude, in seconds.
e. Time from pullup to impact (in seconds) of the BLU-26/B or BLU-36/B or BLU-59/B.
f. Range from pullup to the center of the impact pattern, in feet.

ROCKET LAUNCH AND GUN FIRING TABLES

The 2.75-inch FFAR and 20mm ballistic tables present the sight settings as a function of density altitude, calibrated airspeed, and aircraft gross weight. Aircraft angle of attack and parallax correction is included in the sight setting value.

The launch tables are applicable to all rocket launchers, including the SUU-20/A, A/A bomb and rocket dispenser, suspended from pylon or MER/TER. Seperate tables are required when the rocket warhead affects its trajectory; the launch tables are divided as follows:

a. MK-1 and MK-5 warheads and includes the practice rocket with an inert rocket head.
b. M151 warhead.
c. WDU-4A/A warhead.

Based on 4.0 G pullout, the aircraft should clear the fragment envelope during recovery for all launch conditions listed in the launch tables.

The gun firing tables are applicable to the SUU-16/A, -23/A gun pods and the F-4E nose gun. The conditions listed in the tables provide a ground clearance of at least 50 feet, based on a 4.0 G pullout attained 2.0 seconds after release or firing altitude. The AC should note that dive angle, firing altitude, and firing airspeed has a negligible effect upon the sight setting and therefore may be disregarded. The sight setting is affected by angle of attack, but to a lesser degree than angle of attack affects the 2.75-inch rocket. This is due to the difference in time of flight between the 20mm projectile and rocket. Note also that range and the wind corrections change with time of flight which is affected by dive angle, altitude above target, and airspeed. The outboard guns are harmonized at a slant range of 2250 feet. That is, the outboard gun pods are toed-in to permit the 20mm projectiles to converge at a point 2250 feet forward of the aircraft. The centerline gun pod is aligned with the centerline of the aircraft.

The rocket launch and gun firing tables include the following parameters:

a. Target density altitude: sea level, 5000 feet, and 10,000 feet.

b. Aircraft gross weight: 36,000; 38,000; 40,000; 42,000 and 44,000 pounds.
c. Altitude above target: 200 to 12,000 feet.
d. Launch or firing calibrated airspeed (CAS): 400 to 600 knots.
e. Dive angles: 10° to 60°.

The following data are obtained from the rocket launch and gun firing tables:

a. Sight setting in mils.
b. Slant range in feet.
c. Horizontal range in feet.
d. Wind correction factors in feet per knot of wind and mils per knot wind. Rangewind and crosswind correction factors are the same.
e. Time of flight in seconds.

FLARE DISPENSING TABLES

In T.O. 1F-4C-34-1-2, flare dispensing tables are provided for the SUU-25/A, SUU-25B/A, and SUU-42/A dispensers containing either the MK 24 flare, the LUU-1/B marker, or LUU-2/B flare.

The tables provide the minimum release altitude AGL for flare burnout at impact. The desired burnout altitude AGL must be added to the minimum release altitude AGL to determine the actual release altitude AGL. The flare dispensing table also provides the horizontal distance traveled and vertical drop of the flare prior to ignition. The flare ejection fuze delay time and the flare ignition fuze delay time is set according to mission requirements and the data on the flare dispensing table. Rangewind correction and crosswind correction should be applied using a wind factor of 150 feet per knot of wind.

MLU-32/B99 FLARE (BRITEYE) LEVEL RELEASE TABLE

The horizontal and vertical distance travel of the MLU-39/B99 flare prior to flare ignition is given in the table. The desired burnout altitude AGL, plus 1500 feet for burn time, must be added to the vertical drop distance obtained from the table to determine the minimum level release altitude AGL.

DIVE BOMBING AND LOW LEVEL BOMBING SAMPLE PROBLEM

MISSION CONDITIONS

The following sample problem assumes MK 82 Snakeeye retarded release conditions. The precise planning may not be required for other bombing missions, depending on the accuracy required. The sample problem follows the order outlined in the mission planning form (figure 6-1) to illustrate the computations required to determine the pattern length of a six-bomb ripple release, and the effect of side-ejection error induced by the MER and TER bomb racks. The ripple release mode for the land mine is used only for illustrative purposes. If external tanks are to be carried, the appropriate data would be entered in (4a). Item (4e) is the total external weight including pylons and adapters and racks, and the outbound drag index.

Compute the fuel remaining over target (6): Determine the airplane gross weight over target:

Airplane operating weight (5)	31,100 lbs.
External weight (4e)	9619 lbs.
Fuel remaining over target (6)	4281 lbs.
Airplane gross weight over target (7)	45,000 lbs.

Obtain the target elevation (8) and plot the true course to target: complete items (9) and (10). The minimum aircraft recovery altitude above ground level (AGL) will be established by the major command.

RELEASE CONDITIONS

Safe escape and fuze arming (11) must be considered when using the GP bombs and the 2.75-inch rockets. Refer to figures 6-11 thru 6-14. The release altitude AGL (16) or (28) must be greater than the minimum release altitudes required for safe escape and fuze arming (11). Also, check the fuze arm delay setting plus the fuze tolerance to ensure that the setting is LESS than the bomb time of flight; then, checkoff item (11c). Item (11d) is applicable only to the BLU-31/B Land Mine with the FMU-30/B fuze.

Weather forecast data provides the following:

a. Forecast target temperature (12): 5°C.
b. Wind velocity (24): 360° True/30 knots.

The following charts are used to determine items (15) (19), (20), (21), and (23).

a. Dive Recovery charts, figure 6-2.
b. Altimeter Lag chart, figure 6-8.
c. Angle of Attack chart, figure 6-3.
d. Airspeed Conversion chart, figure 6-4.
e. Altimeter Position Error Correction (F-4C/D), figure 6-7.

The calibrated airspeed release velocity (13), dive angle (15), and release altitude (16) are selected and entered in the form. True airspeed is obtained from figure 6-4 as a function of CAS, forecast temperature, and forecast pressure altitude at release altitude. If forecast pressure altitude is not available, release altitude MSL (17) may be used. If the ripple release mode is used, complete item (18). Use the dive recovery charts to find the altitude lost during pullout (19). The recovery altitude must be greater than the minimum recovery altitude (10). Subtract the altitude lost during pullout from the Release Altitude AGL (16).

1500 feet minus 323 feet = 1177 feet

(F-4C) (F-4D) (F-4E)

Sheet 1 of 7

MISSION PLANNING FORM
NONNUCLEAR

sample

MISSION CONDITIONS

1. Delivery and Release Mode . Dive Bombing - Ripple Release . . . .
2. Munitions MK 82 Snakeye I-Retarded Weight 560 lbs. Drag 2.4
3. FUZING:

	NOSE	TAIL
a. Fuze	M904E2	
b. Arming Delay . . . . (Tolerance ± 10% sec.)	2.0 sec	
c. Functioning Delay	0.01 sec	

4. Drag Index and External Weight:
   a. Outboard: 12 , MK82SE T. wgt. 7550 lbs, Drag Index 49.0
   b. Inboard: — , — T. wgt. — lbs, Drag Index —
   c. Centerline: 1 , Fuel Tank T. wgt. (Empty) 249 lbs, Drag Index 9.6
   d. Fuselage: 4 , Aim-7E T. wgt. 1820 lbs, Drag Index 5.2
   e. Totals: T. wgt. 9619 lbs, Drag Index 63.8
5. Airplane Operating Weight . . . . 31,100 pounds
6. Fuel Remaining Over Target: . . . . 4281 pounds
7. Airplane Gross Weight Over Target (Add: #4e, #5, and #6) . . . . 45,000 pounds
8. TARGET DATA:
   a. Altimeter setting over target . . . . 29.40 in. Hg.
   b. Target Elevation MSL . . . . 250 feet
   c. Target Temperature . . . . 10 °C
   d. Target Pressure Altitude. . . . . 500 feet
   e. Target Density Altitude (forecast or fig 6-5) . . . . Sea Level feet
9. Approach Course to Target . . . . 040 °True
10. Minimum Aircraft Recovery Altitude AGL. (Check #16 minus #19) . . . . 500 feet
    (To be established by Major Command)

°F -130 -120 -110 -100 -90 -80 -70 -60 -50 -40 -30 -20 -10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
°C -90 -80 -70 -60 -50 -40 -30 -20 -10 0 10 20 30 40 50 60

F4-34-V-103-1

Figure 5-3 (Sheet 1 of 3)

(F-4C) (F-4D) (F-4E)

Sheet 2 of 7

MISSION PLANNING FORM
NONNUCLEAR

sample

RELEASE CONDITIONS

11. Safe Escape and Fuze Arming:
    a. Minimum Release Altitude (AGL) for Frag Clearance . . . . 1300 feet
       From Safe Escape Table, figure 6-14 or 6-15.
       (Ensure that #16 or #28 is greater than #11a)
    b. Minimum Release Altitude (AGL) for Fuze Arming . . . . Safe feet
       From Fuze Arming Table, figure 6-13, 6-15 or 6-16.
       (Ensure that #16 or #28 is greater than #11b)
    c. Check Fuze Arm Delay Setting plus Fuze Tolerance,
       is LESS THAN Bomb Time of Flight . . . . (✓)
    d. Impact Velocity of BLU-31/B with FMU-30/B Fuze
       (less THAN 900 fps) . . . . NA fps

12. Forecast Temperature at Release Altitude MSL . . . . 5 °C

13. Calibrated Airspeed Release Velocity . . . . 435 knots

14. True Airspeed Release Velocity (V_R) . . . . 440 knots

15. Dive Angle . . . . 30 degrees

16. Release Altitude AGL (Must be greater than #11) . . . . 2000 feet

17. Release Altitude MSL (#8b + #16). . . . . 2250 feet

18. Ripple Release Interval (I_R) Setting: (.06) (.10) (.14) . . . . . 0.140 sec

19. Altitude Lost During Pullout . . . . (3.0G) (4.0G) (5.0G) . . . . 1153 feet

20. Altimeter Lag . . . . SPC OFF 820 SPC ON 55 feet

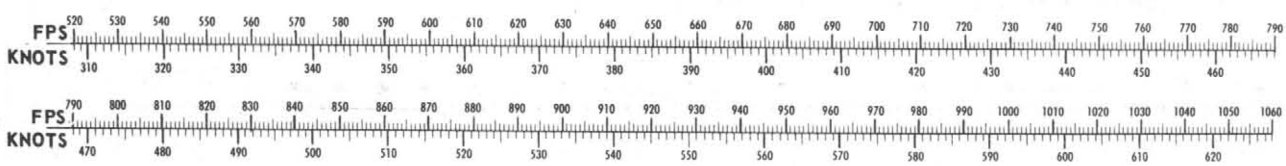
21. Altimeter Position Error Correction (F-4C/D) . . . . SPC ON 0 Δ feet

22. Indicated Release Altitude MSL (Add: #17, #20 & #21) . . SPC OFF 3070 SPC ON 2305 feet

23. Angle of Attack from zero sight line (fig 6-3) . . . . 22 mils

WIND VALUES

24. Forecast Wind Velocity	350	°True	30	knots
25. Relative Wind Velocity (fig 6-11)	310	°	30	knots
26. Rangewind Component (head) ~~(tail)~~	34	fps	20	knots
27. Crosswind Component (left) ~~(right)~~	39	fps	23	knots



F4-34-V-103-2

Figure 5-3 (Sheet 2 of 3)

(F-4C) (F-4D) (F-4E) | Sheet 3 of 7

MISSION PLANNING FORM
NONNUCLEAR

sample

DIVE AND LOW LEVEL BOMBING CONDITIONS (SINGLE) (RIPPLE)

* 28. (Ripple Rel) Release Alt of Last Bomb (Must be greater than #11) . . . . 1428 feet
From Ripple Table or, #16 minus $[(I_R)\ (1.69)\ (V_R)\ (\text{Sin}\ \theta)\ (N\text{-}1)]$

29. Bomb Range (not required if ripple table is used).

a. First Bomb (fr. single table) . . . . — feet

b. Last Bomb (Interpolate table). . . . . — feet

30. Bomb Time of Flight

*a. First Bomb (fr. single or ripple table). . . . . 7.81 seconds

b. Last Bomb (interpolate table) . . . . approx. 5.27 seconds

* 31. Ripple Pattern Length for 12 bombs from ripple table or, ... 556 feet
P.L. = $[(I_R)\ (1.69)\ (V_R)\ (\text{Cos}\ \theta)\ (N\text{-}1)] - \Delta R$

* 32. Range from First Release to Center of Ripple Pattern . . . . 2620 feet
(fr. ripple table or, #29a plus one-half #31)

* 33. Sight Depression from Flight Path (fr. table or Sight Depression charts) . . . . . . 131 mils

34. Sight Setting (no wind) (#23 + #33) . . . . $\boxed{153}$ mils

* 35. Headwind Correction Factor (Add) fr. table . . . . 2.53 mil/knot

* 36. Tailwind Correction Factor (Subtract) fr. table . . . . −2.38 mil/knot

* 37. Crosswind Correction Factor fr. table . . . . 13.2 ft/knot

38. Upwind Aimpoint (single point offset). . . . . 350 °True 396 feet
(Multiply #24 by #37)

39. Relative Wind Vector:

a. Rangewind Correction . . . . (+H) (~~-T~~) 246 feet, or (+H) (~~-T~~) 50.6 mils
(Multiply #26 by #35 or #36 and #37)

b. Crosswind Correction . . . . (left) (~~right~~). . . . . 304 feet
(Multiply #27 by #37)

40. Sight Setting Corrected for Rangewind (#34 ± #39a) . . . . $\boxed{204}$ mils

41. Side Ejection Impact Distance (feet) and Release Sequence (if applicable) fig. 6-6:

IMPACT LEFT ⟵ ⟶ IMPACT RIGHT

STATION 2

Sequence			
Error - ft.			

STATION 8

Sequence			
Error - ft.			

STATION 1

Sequence			
Sequence			
Error - ft.			

STATION 5

STATION 9

Sequence			
Sequence			
Error - ft.			

* Value can be obtained from Ripple Release Table.

F4-34-V-103-3

Figure 5-3 (Sheet 3 of 3)

To determine the indicated release altitude (22), altimeter lag should be added to release altitude MSL. In addition to altimeter lag, altimeter position error should be considered: F-4C/D, figure 6-7.

	SPC Off	SPC On
Release altitude MSL (17)	2250	2250 feet
Altimeter lag (20)	820	55 feet
Altimeter position error (21)		0 feet
Indicated release altitude (22)	3070	2305 feet

Use the angle of attack chart to find the angle of attack in mils (23). Note how angle of attack becomes smaller as the bombs are released and/or as fuel is used, approximately one mil per 1000-lb. bomb. Use the following given conditions.

Note

If release pressure altitude is not known, release altitude MSL may be used (17).

Given: a. Release velocity CAS (14): 435 knots
b. Gross weight at release (7): 45,000 pounds
c. Dive angle (16): 30°

Find: Angle of attack (23): 22 mils

WIND VALUES

Use the relative wind vector chart figure 6-11 to determine the rangewind and crosswind components, based on forecast wind velocity (24). Use the knots-to-feet per second conversion scale, located on the mission planning form.

DIVE AND LOW LEVEL BOMBING CONDITIONS

RIPPLE RELEASE COMPUTATIONS

With Ripple Release Tables

When ripple release tables are provided in T.O. 1F-4C-34-1-2, ripple release computations are reduced to a minimum. The following data are obtained from the tables for a given release interval and number of bombs released (figure 5-4) and entered in the sample planning form figure 5-3.

a. Release altitude of the first bomb (16) and the last bomb (28).
b. Bomb time of flight for the first bomb (30a).
c. Range from first release to the center of the ripple pattern (32).
d. Sight depression from flight path to the center of the ripple pattern (33).
e. Wind correction factors (35), (36), and (37).

The bomb range (29) of the first and last bomb is not required since these values are used to establish the pattern length and sight depression when ripple release tables are not available. The bomb time of flight for the last bomb (30b) should be determined and compared with the fuze setting plus tolerance to ensure that the fuze setting is LESS. To determine the time of flight of the last bomb (30b) interpolate from the bombing table.

Without Ripple Release Tables

Note

The values used in the following example are not applicable to the MK 82 Snakeye bomb and the sample planning form figure 5-3. The values in figure 5-5 are used to show ripple release computations when ripple release tables are not available.

The following computations are not required for single bomb release, or if the pattern length and mid-pattern sight setting are not required. However, the release altitude of the last bomb (28) should be computed to determine that the minimum recovery altitude, bomb fuzing, and safe escape requirements are satisfied.

To determine the release altitude of the last bomb (28), subtract the product of $[(I_R)(1.69)(V_R)(\text{Sine } \theta)(N-1)]$ from the release altitude of the first bomb (16), 1500 feet. Check safe escape and fuze arming (11).

I_R = Release interval setting: 0.14 second.

V_R = True airspeed release velocity: 400 knots.

θ = Dive angle: 15°

Sine θ = 0.25882 (obtained from figure 6-9).

N = Number of bombs in the ripple release: 6.

N-1 = (6-1) = 5.

Release altitude of first bomb

1500 ft. minus [(0.14)(1.69)(400)(0.25882)(5)] = 1396 ft. release altitude of last bomb.

To determine the length of ripple pattern, the range of the last bomb must be computed. Interpolate between the bomb ranges listed for 1500 feet and 1000 feet; for the bomb range of the last bomb released from 1396 feet, use 1400 feet.

3533 ft. range of first bomb minus 2603 ft. range of bomb released from 1000 feet = 930 ft.

Divide the difference by 5 to determine the bomb range per 100-foot release altitude.

930 ft. ÷ 5 = 186 feet per 100 ft. of release altitude

The range of the last bomb release from 1396 feet (or 1400 feet rounded off) equals:

3533 ft. - 186 ft. = 3347 ft. range of last bomb.

RIPPLE RELEASE TABLES

BOMB, GP, 500-LB, MK 82 (SNAKEYE 1)
12 BOMB RIPPLE
RELEASE INTERVAL 140 MILLISECONDS

HIGH DRAG

RELEASE DIVE ANGLE DEG	RELEASE TAS KTS	RELEASE ALT ABOVE TGT FT	RANGE RELEASE TO CENTER OF PATTERN FT	TIME OF FALL FIRST BOMB SEC	RELEASE ALT LAST BOMB FT	PATTERN LENGTH FT	SIGHT DEP FROM FLIGHT PATH MILS	WIND CORRECTION FACTORS HEAD MILS/KNOT	WIND CORRECTION FACTORS TAIL MILS/KNOT	WIND CORRECTION FACTORS CROSS FT/KT
30	400	1700	2284	6.76	1180	461	119	2.50	-2.35	11.4
30	400	1800	2366	7.21	1280	489	130	2.59	-2.43	12.2
30	400	1900	2444	7.66	1380	514	140	2.68	-2.51	12.9
30	400	2000	2516	8.11	1480	539	151	2.77	-2.59	13.7
30	400	2100	2585	8.56	1580	560	162	2.86	-2.67	14.4
30	400	2200	2649	9.01	1680	580	172	2.95	-2.76	15.2
30	400	2300	2707	9.45	1780	603	184	3.04	-2.84	15.9
30	400	2400	2766	9.89	1880	617	194	3.12	-2.91	16.7
30	400	2500	2819	10.33	1980	632	205	3.21	-2.99	17.4
30	400	2600	2870	10.76	2080	648	215	3.29	-3.07	18.2
30	400	2700	2917	11.20	2180	663	226	3.38	-3.15	18.9
30	400	2800	2961	11.63	2280	672	237	3.46	-3.22	19.6
30	400	2900	3005	12.06	2380	685	247	3.54	-3.30	20.4
30	400	3000	3046	12.48	2480	697	257	3.61	-3.37	21.1
~~30~~	~~440~~	~~1900~~	~~2541~~	~~7.36~~	~~1328~~	~~527~~	~~121~~	~~2.45~~	~~-2.30~~	~~12.4~~
30	440	2000	2620	7.81	1428	556	131	2.53	-2.38	13.2
~~30~~	~~440~~	~~2100~~	~~2694~~	~~8.26~~	~~1528~~	~~582~~	~~141~~	~~2.62~~	~~-2.46~~	~~13.9~~
30	440	2200	2764	8.71	1628	606	151	2.71	-2.53	14.7
30	440	2300	2830	9.15	1728	629	162	2.79	-2.61	15.4
30	440	2400	2892	9.59	1828	650	172	2.87	-2.69	16.2
30	440	2500	2950	10.03	1928	671	182	2.95	-2.76	16.9
30	440	2600	3005	10.47	2028	689	192	3.04	-2.84	17.7
30	440	2700	3057	10.90	2128	705	202	3.12	-2.91	18.4
30	440	2800	3106	11.33	2228	721	213	3.19	-2.98	19.1
30	440	2900	3153	11.76	2328	734	223	3.27	-3.06	19.8
30	440	3000	3197	12.19	2428	748	233	3.35	-3.13	20.6

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Figure 5-4

DIVE BOMBING TABLE

SINGLE RELEASE

Note

THIS TABLE IS USED TO SHOW RIPPLE RELEASE COMPUTATION WHEN RIPPLE RELEASE TABLES ARE NOT AVAILABLE.

DIVE ANGLE	TAS	ALT ABOVE TGT	BOMB RANGE	TIME OF FLIGHT	SLANT RANGE FROM REL	IMPACT ANGLE	SIGHT DEP FROM FLIGHT PATH	WIND CORRECTION FACTORS		
								HEAD	TAIL	CROSS
DEG	KTS	FT	FT	SEC	FT	DEG	MILS	MILS/KNOT		FT/KT
15	360	1000	2478	4.42	2672	28	125	1.09	-1.03	7.5
15	380	1000	2543	4.30	2733	27	116	1.01	-0.96	7.3
15	400	1000	2603	4.18	2788	26	108	0.94	-0.90	7.1
15	420	1000	2660	4.07	2842	26	101	0.88	-0.84	6.9
15	440	1000	2712	3.97	2890	25	94	0.83	-0.80	6.7
15	460	1000	2762	3.87	2937	24	88	0.78	-0.75	6.5
15	480	1000	2808	3.77	2981	24	83	0.74	-0.71	6.4
15	500	1000	2851	3.68	3021	23	78	0.70	-0.68	6.2
15	520	1000	2891	3.59	3059	23	74	0.67	-0.64	6.1
15	540	1000	2929	3.50	3095	22	70	0.64	-0.61	5.9
15	560	1000	2964	3.42	3128	22	66	0.61	-0.59	5.8
15	580	1000	2997	3.34	3159	22	63	0.58	-0.56	5.6
15	600	1000	3028	3.27	3189	21	60	0.56	-0.54	5.5
Interpolate		1396	3347	5.45 ← Last bomb				For first bomb on target		
15	360	1500	3337	6.04	3659	32	163	1.18	-1.13	10.2
15	380	1500	3438	5.90	3751	31	152	1.10	-1.05	10.0
15	400	1500	3533	5.77	3838	30	142	1.03	-0.98	9.7
15	420	1500	3622	5.64	3920	29	133	0.96	-0.92	9.5
15	440	1500	3707	5.51	3999	28	125	0.90	-0.86	9.3
15				5.39	4073	28	118	0.85	-0.81	9.1

First bomb

UNCLASSIFIED

F4-34-V-104

Figure 5-5

Interpolate the bombing table to determine the time of flight of the last bomb (30b).

To determine the ripple pattern length (P.L.) for six bombs, subtract the difference between the range of the first and last bomb (Δ R), from the product of $[(I_R)(1.69)(V_R)(\cos\ \theta\ )(N-1)]$.

P.L. = Pattern Length in feet.

I_R = Release interval setting: 0.14 second

V_R = True airspeed release velocity: 400 knots.

θ = Dive angle: 15 degrees.

Cos θ = 0.96593 (obtained from figure 6-7).

N = Number of bombs in the ripple release: 6.

N-1 = (6-1) = 5.

Δ R = Range of first bomb, minus range of last bomb: 186 feet.

P.L. = [(0.14)(1.69)(400)(0.96593)(5)] - 186 ft.

P.L. = 200 feet.

To determine the sight depression angle from flight path to the center of the ripple pattern (33), enter the applicable sight depression chart with the range from release of the first bomb to the center of the ripple pattern (32); this range is determined by adding one-half of the ripple pattern length to the range of the first bomb.

3533 ft. range of first bomb plus (200 ÷ 2) = 3633 ft.

Enter the 15° dive, sight depression chart with:

a. Range from release to target (32): 3633 ft.
b. Release altitude AGL (17): 1500 ft.
c. Read sight depression angle from flight path (33): 139 mils.

To determine the sight setting for no-wind (34), add the angle of attack from zero sight line (23).

139 mils + (-2 mils) = 137 mils.

Rangewind correction can be made by adjusting the sight setting or by estimating an aim point based on the rangewind effect (for a headwind the bomb will hit short of the target).

(1.0 mil/knot) (20 knots headwind) = 20.0 mils.

or

(9.7 ft./knot)(20 knots headwind) = 194 ft. short of target

Therefore add 20 mils to the no-wind sight setting or aim 194 feet long.

Crosswind correction can be made by determining the wind effect of the bomb, using the crosswind factor.

(9.7 ft./knot(23 knots left crosswind) = 223 ft. left.

Note

> Crosswind correction is not required for low level bombing with low drag bombs if the aircraft ground track through the target is maintained until release occurs.

The no-wind side ejection error is obtained from figure 6-6, side ejection impact distance chart. Enter the distance that the bomb will be ejected, left and right of the aircraft flight path, in the mission planning form and in the checklist. Select the applicable aircraft station, enter the chart with the weight of the bomb (2), project through time of fall (30) curves, and then project down from the curve applicable to the MER or TER position (Inboard, Bottom, and Outboard to read the lateral displacement of the bomb from the centerline of the aircraft, left or right.

WRCS DELIVERY MODES (F-4D AND F-4E)

When the WRCS delivery modes are used, a minimum of planning should include the following items:

a. Mission conditions, items (1) thru (10).
b. Safe escape and fuze arming (11).
c. Release and jettison limitations from T.O. 1F-4C-1 Flight Manual.
d. WRCS counter settings (79) thru (83).

ROCKET LAUNCH AND GUN FIRING SAMPLE PROBLEM

ROCKET LAUNCH AND GUN FIRING CONDITIONS

The rocket launch and gun firing data, items (42) thru (50), are obtained directly from the tables, based on the established mission conditions, release conditions, and wind values outlined in the mission planning form, figure 6-1. The mission conditions and release conditions are assigned and determined by the same procedure outlined for the Dive and Low Level Bombing sample problem. These procedures are not repeated here: however, a completed sample mission planning form (figure 5-6) has been prepared for the rockets using launch table figure 5-7.

The applicable launch table is selected by establishing the following conditions:

a. Type of rocket warhead: MK-1 warhead.
b. Target density altitude:
c. Dive angle:
d. Calibrated airspeed:
e. Aircraft gross weight:

The sight setting corrected for rangewind is obtained by adding the rangewind correction (46) or (47) for headwind, or subtracting for tailwind, from the no-wind sight setting (43).

39 mils + 8 mils = 47 mils.

(F-4C) (F-4D) (F-4E)

Sheet 1 of 7

MISSION PLANNING FORM
NONNUCLEAR

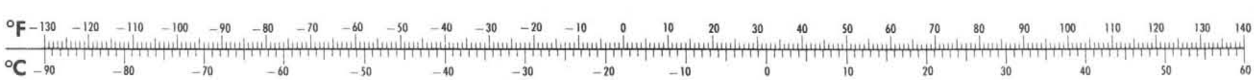
sample

MISSION CONDITIONS

1. Delivery and Release Mode . Rocket Launch . . . .
2. Munitions 2.75 inch FFAR Lau-3/A Weight 427 lbs. Drag 4.2 pounds
3. FUZING:

	NOSE	TAIL
a. Fuze		
b. Arming Delay . . . (Tolerance ± ________ sec.)		
c. Functioning Delay		

4. Drag Index and External Weight:
   - a. Outboard: 2 , 370 Tanks T. wgt. 680 lbs, Drag Index 9.6
   - b. Inboard: 6 , Lau-3/A T. wgt. 3280 lbs, Drag Index 38.8
   - c. Centerline: 1 , SUU-21/A T. wgt. 620 lbs, Drag Index 3.3
   - d. Fuselage: 4 , Aim-7E T. wgt. 1820 lbs, Drag Index 5.2
   - e. Totals: . . . . T. wgt. 6400 lbs, Drag Index 56.9
5. Airplane Operating Weight . . . . 31,000 pounds
6. Fuel Remaining Over Target: . . . . 4500 pounds
7. Airplane Gross Weight Over Target (Add: #4e, #5, and #6) . . . . 42,000 pounds
8. TARGET DATA:
   - a. Altimeter setting over target . . . . 29.92 in. Hg.
   - b. Target Elevation MSL . . . . 0 feet
   - c. Target Temperature . . . . 15 °C
   - d. Target Pressure Altitude. . . . . 0 feet
   - e. Target Density Altitude. . . . . 0 feet
9. Approach Course to Target . . . . 040 °True
10. Minimum Aircraft Recovery Altitude AGL. (Check #16 minus #19) . . . . 500 feet
    (To be established by Major Command)



F4-34-V-105-1

Figure 5-6 (Sheet 1 of 3)

(F-4C) (F-4D) (F-4E)

Sheet 2 of 7

MISSION PLANNING FORM
NONNUCLEAR

sample

RELEASE CONDITIONS

11. Safe Escape and Fuze Arming:

a. Minimum Release Altitude (AGL) for Frag Clearance . . . . 1800 feet
From Safe Escape Table, figure 6-14, or 6-15.
(Ensure that #16 or #28 is greater than #11a)

b. Minimum Release Altitude (AGL) for Fuze Arming . . . . NA feet
From Fuze Arming Table, figure 6-13, 6-15 or 6-16.
(Ensure that #16 or #28 is greater than #11b)

c. Check Fuze Arm Delay Setting plus Fuze Tolerance, is LESS THAN Bomb Time of Flight . . . . (NA)

d. Impact Velocity of BLU-31/B with FMU-30/B Fuze (less THAN 900 fps) . . . . NA fps

12. Forecast Temperature at Release Altitude MSL . . . . 11 °C

13. Calibrated Airspeed Release Velocity . . . . 440 knots

14. True Airspeed Release Velocity (V_R) . . . . $\boxed{435 \text{ knots}}$

15. Dive Angle . . . . 30 degrees

16. Release Altitude AGL (Must be greater than #11) . . . . 2000 feet

17. Release Altitude MSL (#8b + #16) . . . . 2000 feet

18. Ripple Release Interval (I_R) Setting: (.06) (.10) (.14) . . . . . . — sec

19. Altitude Lost During Pullout (3.0G) (4.0G) (5.0G) . . . . 1200 feet

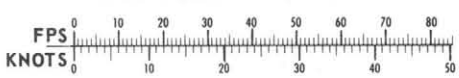
20. Altimeter Lag . . . . SPC OFF 800 SPC ON 55 feet

21. Altimeter Position Error Correction (F-4 C/D) . . . . SPC ON — Δ feet

22. Indicated Release Altitude MSL (Add: #17, #20 & #21) SPC OFF 2800 SPC ON 2055 feet

23. Angle of Attack from zero sight line (fig 6-3) . . . . 18 mils

WIND VALUES

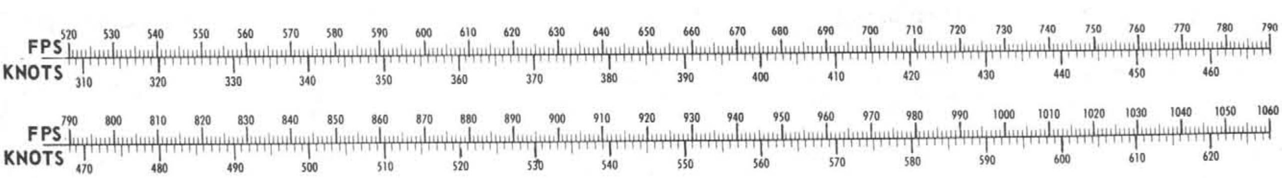


24. Forecast Wind Velocity . . . . 350 °True 30 knots

25. Relative Wind Velocity (fig 6-11) . . . . 310 ° 30 knots

26. Rangewind Component (head) ~~(tail)~~ . . . . 34 fps 20 knots

27. Crosswind Component (left) ~~(right)~~ . . . . 39 fps 23 knots



F4E-34-V-105-2

Figure 5-6 (Sheet 2 of 3)

(F-4C) (F-4D) (F-4E)

Sheet 4 of 7

MISSION PLANNING FORM
NONNUCLEAR

sample

ROCKET LAUNCH AND GUN FIRING CONDITIONS
Rocket Warhead Used: (MK-1) (MK-5, Heat) (Practice)(M151)(WDU-4A/A)

42. Time of Flight . . . . 1.92 seconds

43. Sight Setting (no wind) . . . . 39 mils

44. Slant Range . . . . 3875 feet

45. Horizontal Range . . . . 3319 feet

46. Wind Correction . . . . 3 feet per knot

47. Wind Correction . . . . 0.4 mils per knot

48. Upwind Aimpoint (single point offset) . . . . 350 °True 90 feet
(Multiply #24 by #46)

49. Relative Wind Vector:
a. Rangewind Correction (Multiply #26 by #47) (+H) ~~(-T)~~ . . . . 8 mils
b. Crosswind Correction (Multiply #27 by #46) (left) ~~(right)~~ . . . . 69 feet

50. Sight Setting Corrected for Rangewind (#43 ± #49a) (+H) ~~(-T)~~ . . . . 47 mils

LOFT BOMBING RIPPLE RELEASE CONDITIONS

51. Approach Calibrated Airspeed . . . . ______ knots

52. Approach True Airspeed (fig 6-4) . . . . fps, knots

53. Approach Altitude AGL . . . . ______ feet

54. Indicated Approach Altitude MSL (Add: #8b, #53, #21) . . . . ______ feet

55. FIRST BOMB (from table):

a. Release Angle of First Bomb . . . . ______ degrees

b. LOW ANGLE Release Gyro Setting (table) . . . . degrees

c. Release Altitude AGL . . . . ______ feet

d. Time from Pullup to Release (t_b) . . . . ______ seconds

e. Range from Pullup to Impact ($R_2 + R_3$) . . . . ______ feet

f. Time from Release to Impact (t_c) (check #11c) . . . . ______ seconds

56. Time Required to Ripple____Bombs (#19 times N-1) . . . . ______ seconds
(Multiply Interval Setting by number of bombs, minus one bomb).

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Figure 5-6 (Sheet 3 of 3)

ROCKET LAUNCH TABLE

2.75 INCH FFAR WITH MK-1/MK-5 WARHEAD AND PRACTICE ROCKET
LAU-3, LAU-32, LAU-59 AND SUU-20 LAUNCHERS
TARGET DENSITY ALTITUDE - MEAN SEALEVEL

ALT ABOVE TGT FT	KCAS	DIVE ANGLE DEG	TIME OF FLT SEC	AIRCRAFT GROSS WEIGHT - THOUSANDS OF POUNDS: 36 (SIGHT SETTING - MILS, NEG SETTING INDICATES ELEV)	38	40	42	44	36 (SLANT RANGE - FEET)	40	44	36 (HORIZONTAL RANGE - FT)	40	44	WIND CORRECTIONS FACTORS FT/KT	MIL/KT
1500	400	30	1.62	40	41	43	45	46	2913	2917	2921	2497	2502	2507	3	.5
1500	440	30	1.59	33	34	35	37	38	2912	2915	2918	2496	2500	2504	3	.5
1500	480	30	1.56	27	28	30	31	32	2914	2916	2918	2498	2501	2503	3	.5
2000	400	30	1.96	41	43	45	46	48	3869	3875	3880	3312	3319	3325	3	.4
2000	440	30	1.92	34	36	37	39	40	3869	3873	3877	3312	3316	3321	3	.4
2000	480	30	1.88	29	30	31	32	34	3871	3874	3877	3314	3318	3321	3	.4
2000	520	30	1.85	25	26	27	28	29	3874	3877	3879	3318	3321	3324	3	.4
2000	560	30	1.81	21	22	22	23	24	3878	3880	3882	3323	3325	3327	3	.4
2500	400	30	2.32	43	45	46	48	50	4820	4827	4833	4121	4129	4137	4	.4
2500	440	30	2.27	36	37	39	40	42	4820	4825	4830	4121	4127	4132	4	.4
2500	480	30	2.23	30	32	33	34	35	4824	4827	4831	4125	4129	4134	4	.4
2500	520	30	2.18	26	27	28	29	30	4828	4831	4834	4130	4134	4137	4	.4
2500	560	30	2.14	22	23	24	25	26	4833	4835	4838	4136	4139	4142	4	.4
2500	600	30	2.10	19	20	20	21	22	4839	4841	4843	4143	4146	4148	4	.4

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Figure 5-7

LOFT BOMBING SAMPLE PROBLEM

LOFT BOMBING RIPPLE RELEASE CONDITIONS

Sample mission planning form (figure 5-8) is provided to establish mission conditions, release conditions, and wind values for this sample problem. The purpose of the following computations is to establish the following:

a. Low angle release gyro setting.
b. Approximate pattern length.
c. Pullup timer setting for no-wind and forecast rangewind.
d. Aircraft exposure time above a given altitude.
e. WRCS LABS/TGT FIND R_R setting.

Complete sheet 1 of the Mission Planning Form. On sheet 2, complete item (11c) after the bomb time-of-flight is determined. Items (11a) and (11b) are not applicable to Loft Bombing. Also, complete items (24) thru (27) Target Wind Values if available. To determine the target density altitude, refer to Altitude Conversion chart. Enter the chart with target pressure altitude and target temperature, read target density altitude. Density altitude is required to select the proper set of loft bombing tables. Linear interpolation between sets of density altitude bombing table should be accomplished or at least considered.

To obtain the approach true airspeed (52), enter the airspeed conversion chart (figure 6-4) with the following conditions and read, 400 knots:

a. Calibrated airspeed approach velocity (51): 395 knots.
b. Forecast temperature at approach altitude (8c): 20°C.
c. Approach pressure altitude or approach altitude MSL (target pressure altitude, plus, approach altitude AGL): 300 ft.

0 ft. + 300 ft. = 300 ft.

Altimeter position error for F-4C/D aircraft with Static Correction Operating (21) is determined by reference to figure 6-7. Indicate approach altitude MSL (54) is the sum of items (8b), (53), and (21).

Select the loft bombing table computed for the following given conditions (figure 5-9):

a. Gross weight of aircraft at pullup (7): 43,330 pounds. Use the table computed for 42,000 pounds gross weight.
b. Target density altitude (8e): 500 feet.
c. Approach altitude AGL (53): 300 feet.
d. Approach velocity true airspeed (52): 500 knots.

Enter the following conditions for the FIRST BOMB in the mission planning form:

a. Release angle of first bomb (55a), 30°. The release angle of the first bomb, the number of bombs to be released and the release interval will establish the pattern length. Note that when the release angle is greater than 45°, the range from pullup to impact decreases.
b. Low angle release gyro setting (54b): 36.9
c. Release altitude AGL (55c): 1250 feet.
d. Time from pullup to release, t_b (55d): 5.55 seconds.
e. Range from pullup to impact, $R_2 \div R_3$ (55e): 22,255 feet.
f. Time from release to impact, t_c (55f): 27.20 seconds.

Determine the time required to ripple release the desired number of bombs (56). Six bombs will require 0.70 seconds when released with the interval selector switch positioned on 0.14 SEC. Multiply the interval setting by the number of bombs minus one bomb (N-1).

5 times 0.14 sec. = 0.70 second.

The time from pullup to the release of the last bomb (57a) is the sum of items (56) and (55d).

5.55 sec. + 0.70 sec. = 6.25 sec.

Interpolate the bombing table if necessary for release angle that provides a time from pullup to release equal to that computed for the last bomb (57a), using the same release conditions that were used for the first bomb. Record the following conditions for the LAST BOMB:

a. Release angle (57b): 35°.
b. Release altitude AGL (57c): 1546 feet.
c. Range from pullup to impact, R_2 to R_3 (57d): 23,530 feet.
d. Time from release to impact, t_c (57c): 30.64 seconds.

The approximate pattern length (58) is equal to the $R_2 + R_3$ range of the last bomb, minus the $R_2 + R_3$ range of the first bomb.

23,530 ft., minus 22,255 ft. = 1275 ft.

To determine the pullup timer setting, the approximate range from pullup to the center of the ripple pattern (59) must be known: add one-half of the pattern length to the $R_2 + R_3$ range of the first bomb (55e).

22,255 ft. + (1275 ÷ 2) = 22,893 ft.

Note

When the LABS/Target Find mode is used, item (59) is used to determine the value set on the WRCS Release Range (R_R) counter. Refer to item (64) WRCS LABS/TGT Find Corrections. Complete item (83).

From the target map or photos, select an IP and measure the IP-to-target distance (60). Determine the IP-to-pullup distance (61) by subtracting the pullup-to-center of pattern distance (59), from IP-to-target distance (60).

29,000 ft., - 22,893 ft. = 6107 ft.

The pullup timer setting for no-wind (62) is determined by dividing the IP-to-pullup distance (61) by the approach true airspeed in feet per second (52).

6107 ft. ÷ 844 fps = 7.2 seconds.

Crosswind correction is not required if the crab angle established during the run-in approach is maintained in the pullup until final bomb release.

Rangewind correction is applied to the Pullup Timer and computed as a function of groundspeed. The effect is to move the pullup point toward the target for a headwind and conversely for a tailwind. The correction time is added for a headwind and subtracted for a tailwind. Rangewind correction for the Pullup-to-Impact ($R_2 + R_3$) range can be obtained from the loft bombing wind correction table (figure 6-19). Enter the table with the approach TAS (52), the release angle of the middle bomb, and the rangewind component (26).

Another method to correct $R_2 + R_3$ is to use the following equation:

$$W_R\,(t_b + t_c) \div Vgs$$

where:

W_R	= Rangewind Component in feet per second.
$t_b + t_c$	= Time from pullup to impact of last bomb.
Vgs	= Approach groundspeed in feet per second.

Determine the aircraft groundspeed (63a) in feet per second: add or subtract the rangewind component (26) from the approach true airspeed (52). Subtract for headwind, add for tailwind.

844 fps - 34 fps = 810 fps.

The pullup timer setting corrected for rangewind is the sum of the $R_2 + R_3$ wind correction time (63b) and the groundspeed IP-to-pullup time (63c). Add the $R_2 + R_3$ wind correction for headwind, subtract for tailwind.

+ 1.5 sec. + 7.5 sec. = 9.0 sec.

When the WRCS LABS/Target Find mode is used, the Release Range (R_R) counter setting (64e) is corrected to include Pullup Timer lead-in time and, if necessary, $R_2 + R_3$ wind correction.

The exposure time of the aircraft above a given altitude may be obtained from the exposure time chart (figure 6-18).

(F-4C) (F-4D) (F-4E)

Sheet 1 of 7

MISSION PLANNING FORM
NONNUCLEAR

sample

MISSION CONDITIONS

1. Delivery and Release Mode . . . . Loft Bombing - Ripple Release . . . .
2. Munition . . . . . M117 G.P. (M131A1 Fin) Weight 820 lbs. Drag 4.2
3. Fuzing:

	NOSE	TAIL
a. Fuze	M904E1	
b. Arming Delay . . . . (Tolerance ± 20% sec.).	6 sec	
c. Functioning Delay	0.10 sec	

4. Drag Index and External Weight:

a. Outboard: 2 , Empty Tank T. wgt. 680 lbs, Drag Index 9.6

b. Inboard: 6 , M117 GP T. wgt. 5638 lbs, Drag Index 38.8

c. Centerline: 1 , Gun Pods T. wgt. 1702 lbs, Drag Index 8.1

d. Fuselage: 4 , AIM-7E T. wgt. 1820 lbs, Drag Index 5.2

e. Totals: . . . . T. wgt. 9840 lbs, Drag Index 61.7

5. Airplane Operating Weight . . . . 29,800 pounds
6. Fuel Remaining Over Target: . . . . 3,690 pounds
7. Airplane Gross Weight Over Target (Add: #4e, #5, and #6) . . . . 43,330 pounds

8. TARGET DATA:
   a. Altimeter setting over target . . . . 29.92 in. Hg.
   b. Target Elevation MSL . . . . 550 feet
   c. Target Temperature . . . . 20 °C
   d. Target Pressure Altitude. . . . . 0 feet
   e. Target Density Altitude (forecast or fig 6-5) . . . . 500 feet

9. Approach Course to Target . . . . 040 °True

10. Minimum Aircraft Recovery Altitude AGL. (Check #16 minus #19). . . . . NA feet
(To be established by Major Command)

°F -130 -120 -110 -100 -90 -80 -70 -60 -50 -40 -30 -20 -10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
°C -90 -80 -70 -60 -50 -40 -30 -20 -10 0 10 20 30 40 50 60

F4-34-V-106-1

Figure 5-8 (Sheet 1 of 4)

(F-4C) (F-4D) (F-4E)

Sheet 2 of 7

MISSION PLANNING FORM
NONNUCLEAR

sample

RELEASE CONDITIONS

11. Safe Escape and Fuze Arming:

a. Minimum Release Altitude (AGL) for Frag Clearance . . . . NA feet
From Safe Escape Table, figure 6-14 or 6-15.
(Ensure that #16 or #28 is greater than #11a)

b. Minimum Release Altitude (AGL) for Fuze Arming . . . . NA feet
From Fuze Arming Table, figure 6-13, 6-15 or 6-16.
(Ensure that #16 or #28 is greater than #11b)

c. Check Fuze Arm Delay Setting plus Fuze Tolerance,
is LESS THAN Bomb Time of Flight . . . . (✓)

d. Impact Velocity of BLU-31/B with FMU-30/B Fuze
(LESS THAN 900 fps) . . . . NA fps

12. Forecast Temperature at Release Altitude MSL . . . . — °C

13. Calibrated Airspeed Release Velocity . . . . ______ knots

14. True Airspeed Release Velocity (V_R) . . . . — knots

15. Dive Angle . . . . NA degrees

16. Release Altitude AGL (Must be greater than #11) . . . . — feet

17. Release Altitude MSL (#8b + #16) . . . . — feet

18. Ripple Release Interval (I_R) Setting: . . . (.06) . . . (.10) . . . (.14) . . . . . 0.140 sec

19. Altitude Lost During Pullout (3.0G) (4.0G) (5.0G) . . . . NA feet

20. Altimeter Lag . . . . SPC OFF NA . . SPC ON NA feet

21. Altimeter Position Error Correction (F-4C/D) . . . . SPC ON 0 Δ feet

22. Indicated Release Altitude MSL (Add: #17, #20, & #21). SPC OFF — SPC ON — feet

23. Angle of Attack from zero sight line (fig 6-3) . . . . — mils

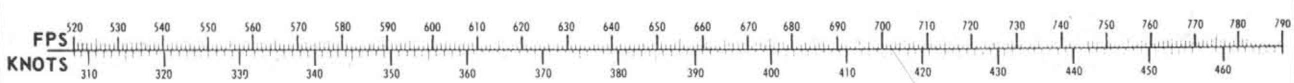
WIND VALUES

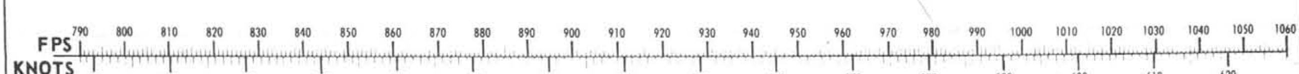
24. Forecast Wind Velocity . . . . 350 °True . . . 30 knots

25. Relative Wind Velocity (fig 6-11) . . . . 310 ° . . . . . 30 knots

26. Rangewind Component (head) ~~(tail)~~ . . . . 34 fps . . . . 20 knots

27. Crosswind Component (left) ~~(right)~~ . . . . 39 fps . . . . 23 knots





F4-34-V-106-2

Figure 5-8 (Sheet 2 of 4)

(F-4C) (F-4D) (F-4E)

Sheet 4 of 7

MISSION PLANNING FORM
NONNUCLEAR

sample

ROCKET LAUNCH AND GUN FIRING CONDITIONS

Rocket Warhead Used: (MK-1) (MK-5, Heat) (Practice) (M151) (WDU-4A/A)

42. Time of Flight . . . . ________ seconds
43. Sight Setting (no wind) . . . . ________ mils
44. Slant Range . . . . ________ feet
45. Horizontal Range . . . . ________ feet
46. Wind Correction . . . . ________ feet per knot
47. Wind Correction . . . . ________ mils per knot
48. Upwind Aimpoint (single point offset) . . . . . . ________ °True ________ feet
(Multiply #24 by #46)
49. Relative Wind Vector:
   a. Rangewind Correction (Multiply #26 by #47)(+H)(-T) . . . . . . ________ mils
   b. Crosswind Correction (Multiply #27 x #46)(left)(right) . . . . . . ________ feet
50. Sight Setting Corrected for Rangewind (#43 ± #49a) (+H) (-T) . . . . . . $\boxed{\quad}$ mils

LOFT BOMBING RIPPLE RELEASE CONDITIONS

51. Approach Calibrated Airspeed . . . . 497 knots
52. Approach True Airspeed (fig 6-4) . . . . . . $\boxed{\text{844 fps, 500 knots}}$
53. Approach Altitude AGL . . . . 300 feet
54. Indicated Approach Altitude MSL (Add; #8b, #53, #21) . . . . . . 850 feet
55. FIRST BOMB (from table):
   a. Release Angle of First Bomb . . . . 30 degrees
   b. LOW ANGLE Release Gyro Setting (table) . . . . . . $\boxed{\text{36.9 degrees}}$
   c. Release Altitude AGL . . . . 1250 feet
   d. Time from Pullup to Release (t_b) . . . . 5.55 seconds
   e. Range from Pullup to Impact ($R_2 + R_3$) . . . . 22,255 feet
   f. Time from Release to Impact (t_c) . . . . 27.20 seconds
56. Time Required to Ripple 6 Bombs at 140 msec Interval . . . 0.70 seconds
(Multiply Interval Setting by number of bombs, minus one bomb).

F4-34-V-106-3

Figure 5-8 (Sheet 3 of 4)

(F-4C) (F-4D) (F-4E)	Sheet 5 of 7

MISSION PLANNING FORM
NONNUCLEAR

sample

57. LAST BOMB:

a. Time from Pullup to Release, t_b, (#56 + #55d) . . . . 6.25 seconds

b. Release Angle (Obtained from the line that provides #57a) . . . . 35 degrees

c. Release Altitude AGL . . . . 1546 feet

d. Range from Pullup to Impact ($R_2 + R_3$) . . . . 23,530 feet

e. Time from Release to Impact (t_c) (Check #11C) . . . . 30.64 seconds

58. Approx. Pattern Length (#57d minus #55e) . . . . $\boxed{1275 \text{ feet}}$

59. Approx. Range from Pullup to Center of Pattern (#55e plus one-half #58) . . . . 22,893 feet

60. IP-to-Target Distance (from map or photos) . . . . 29,000 feet

61. IP-to-Pullup Distance (#60 minus #59) . . . . $\boxed{6107 \text{ feet}}$

62. Pullup Timer Setting (#61 ÷ #52 fps) . . . . $\boxed{7.2 \text{ seconds}}$

63. RANGEWIND CORRECTION:

a. Aircraft ground speed (#52 ± #26) . . . . 810 fps

b. R_2 and R_3 Wind Correction Time (fig 6-19) or . . . . (+H, ~~-T~~) +1.5 seconds
[(#57a + 57e) times (#26, fps)] ÷ #63a.

c. Ground speed IP-to-Pullup Time (#61 ÷ #63a) . . . . 7.5 seconds

d. Pullup Timer Setting, Range wind Corrected (#63c ± 63b) . . . . $\boxed{9.0 \text{ seconds}}$

64. WRCS LABS/TGT FIND CORRECTIONS:

a. Pullup Timer Lead-in Time desired . . . . $\boxed{1.0 \text{ second}}$
(Minimum Pullup Timer Setting is 0.1 sec.)

b. Aircraft ground speed (#51 ± #26) . . . . 810 fps

c. Pullup Timer Setting Converted to Distance . . . . (+) 810 feet
(#64a) times (#64b)

d. $R_2 + R_3$ Wind Correction Distance (head) ~~(tail)~~ . . . . (-H, ~~+T~~) -1253 feet
(#57a + 57e) times (#26fps)

e. Release Range (R_R) Setting . . . . $\boxed{22,450 \text{ feet}}$
(#59 + #64c ± 64d)

F4-34-V-106-4

Figure 5-8 (Sheet 4 of 4)

LOFT BOMBING TABLE

BOMB, GP, 750-LB, M117
4.0 G MILITARY POWER AT PULLUP
42,000 LBS GROSS WEIGHT

TARGET DENSITY ALT	APPROACH		PULL-UP	RELEASE		TIME PULLUP TO RELEASE	RELEASE GYRO SETTING	RANGE PULL-UP TO IMPACT	TIME RELEASE TO IMPACT
	ALT	TAS		ALT	ANGLE				
FT	FT	KTS	G	FT	DEG	SEC	DEG	FT	SEC
0	300	500	4.0	748	20	4.09	26.3	17701	19.41
500 ft				841	22	4.41	28.5	18844	21.09
				932	24	4.69	30.5	19832	22.66
				1029	26	4.97	32.6	20729	24.19
				1139	28	5.27	34.8	21552	25.73
			First Bomb →	1250	30	5.55	36.9	22255	27.20
				1367	32	5.83	39.0	22859	28.64
				1483	34	6.09	41.1	23335	29.97
	Interpolate for Last Bomb →			1546	35	6.25		23530	30.64
				1612	36	6.37	43.3	23724	31.31
				1740	38	6.64	45.5	24005	32.58
				1871	40	6.91	47.6	24180	33.78
				1990	42	7.16	49.7	24235	34.84
				2147	44	7.44	52.1	24205	36.03
					46	7.69	54.3	24074	37.03
					48		56.5	23854	38.00

F4-34-V-110

Figure 5-9

INFLIGHT CONSIDERATIONS

ERROR SENSITIVITY SUMMARY

DELIVERY ERRORS – Level & Dive Delivery			
Release Parameter	RELEASE ERROR	HIT SHORT	HIT LONG
Dive Angle	SHALLOW	✓	
	STEEP		✓
Release Height	HIGH	✓	
	LOW		✓
Airspeed	SLOW	✓	
	FAST		✓
G-loading at Release	HIGH	✓	
	LOW		✓

F4-34-V-107

Figure 5-10

The following is a summary of inflight considerations that will directly affect the success of the weapons delivery mission (figure 5-10). The aircrew must be aware of the least critical and the most critical parameters associated with each mode of delivery. Knowledge of the parameter sensitivity will arm the aircrew with the information required to evaluate a delivery situation where, in combat, the delivery parameters are seldom as planned and may change for each attack.

AIRSPEED

All weapon data tables are based on true airspeed; however, the AC should fly calibrated airspeed for dive deliveries where rapid changes in airspeed, altitude, and temperature are experienced, since rapid changes in these parameters cause the air data computer (ADC) to provide an erroneous true airspeed readout. Calibrated airspeed must be corrected for outside air temperature at the release pressure altitude to obtain true airspeed. Errors of 30 knots can exist if these corrections are not made, and/or the TAS indicator is used for dive deliveries where rapid changes in temperature and pressure exist.

ANGLE OF ATTACK

Angle of attack error will cause an equal aiming error; i.e., the line of sight with the pipper, rotates vertically in proportion to the change in angle of attack. The aircraft operates within an angle of attack envelope that is approximately 300 mils. The parameters that determine the position of the aircraft within the envelope must be controlled. These parameters are included on the angle of attack card: release true airspeed, dive angle, pressure altitude, temperature, gross weight, and NORMAL-G-LOADING. The AC should strive to maintain the normal G loading for the dive angle. Extreme angle of attack error will result with a ± one-quarter G-loading error at the time of bomb release. The sensitivity of the remaining angle-of-attack parameters on the weapon data card can be observed by comparaison. Note the effect of gross weight is approximately one mil per 1000 pounds of fuel used and bombs released.

DELIVERY MODE

The parameters most sensitive with the dive bomb delivery are dive angle, release airspeed, and release altitude, in that order. Low-level bombing with fire bombs (napalm) requires an accurate release altitude. For strafing, the slant range is all-important. When firing the 2.75-inch rockets, G-loading and airspeed must be controlled. Refer to the error analysis in Section VI for a more accurate and detailed examination of the various delivery parameters.

SECTION VI PLANNING CHARTS and TABLES

TABLE OF CONTENTS

BALLISTIC TABLES

The following is an index of tables presented in the ballistics manuals T.O. 1F-4C-34-1-2 and T.O. 1F-4C-34-1-2A. Since the change/revision schedules of these manuals may not coincide, this index may not reflect the latest ballistic table changes and additions.

(F-4C) (F-4D) (F-4E)

Sheet 1 of 7

MISSION PLANNING FORM
NONNUCLEAR

MISSION CONDITIONS

1. Delivery and Release Mode ____________________

2. Munition ____________________ Weight __________ lbs. Drag __________

3. FUZING:

	NOSE	TAIL
a. Fuze		
b. Arming Delay ..... (Tolerance ± ______ sec.)		
c. Functioning Delay (sec.)		

4. Drag Index and External Weight:

   a. Outboard: _____ , __________ T. wgt. __________ lbs, Drag Index __________

   b. Inboard: _____ , __________ T. wgt. __________ lbs, Drag Index __________

   c. Centerline: _____ , __________ T. wgt. __________ lbs, Drag Index __________

   d. Fuselage: _____ , __________ T. wgt. __________ lbs, Drag Index __________

   e. Totals: __________ T. wgt. __________ lbs, Drag Index

5. Airplane Operating Weight .... __________ pounds

6. Fuel Remaining Over Target: .... __________ pounds

7. Airplane Gross Weight Over Target (Add: #4e, #5, and #6) .... pounds

8. TARGET DATA:
   a. Altimeter setting over target .... ______ in. Hg.

   b. Target Elevation MSL .... ______ feet

   c. Target Temperature .... ______ °C

   d. Target Pressure Altitude .... ______ feet

   e. Target Density Altitude (forecast or fig 6-5) .... ______ feet

9. Approach Course to Target .... ______ °True

10. Minimum Aircraft Recovery Altitude AGL. (Check #16 minus #19) .... ______ feet
    (To be established by Major Command)

F4-34-VI-101-1

Figure 6-1 (Sheet 1 of 7)

(F-4C) (F-4D) (F-4E)

Sheet 2 of 7

MISSION PLANNING FORM
NONNUCLEAR

RELEASE CONDITIONS

11. Safe Escape and Fuze Arming:

 a. Minimum Release Altitude (AGL) for Frag Clearance . . . . ________ feet
 From Safe Escape Table, figure 6-14 or 6-15.
 (Ensure that #16 or #28 is greater than #11a)

 b. Minimum Release Altitude (AGL) for Fuze Arming . . . . ________ feet
 From Fuze Arming Table, figure 6-13, 6-15 or 6-16.
 (Ensure that #16 or #28 is greater than #11b)

 c. Check Fuze Arm Delay Setting plus Fuze Tolerance,
 is LESS THAN Bomb Time of Flight . . . . (________)

 d. Impact Velocity of BLU-31/B with FMU-30/B Fuze
 (LESS THAN 900 fps) . . . . ________ fps

12. Forecast Temperature at Release Altitude MSL . . . . ________ °C

13. Calibrated Airspeed Release Velocity . . . . ________ knots

14. True Airspeed Release Velocity (V_R) . . . . ________ knots

15. Dive Angle . . . . ________ degrees

16. Release Altitude AGL (Must be greater than #11) . . . . ________ feet

17. Release Altitude MSL (#8b + #16) . . . . ________ feet

18. Ripple Release Interval (I_R) Setting: . . . (.06) . . . (.10) . . . . (.14) . . . . . . ________ sec

19. Altitude Lost During Pullout (3.0G) (4.0G) (5.0G) . . . . ________ feet

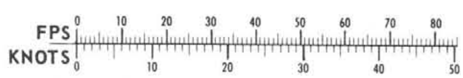
20. Altimeter Lag . . . . SPC OFF ________ SPC ON ________ feet

21. Altimeter Position Error Correction(F-4C/D) . . . . .SPC ON ________ Δ feet

22. Indicated Release Altitude MSL (Add: #17, #20 & #21) . . . . SPC OFF ________ SPC ON ________ feet

23. Angle of Attack from zero sight line (fig 6-3) . . . . ________ mils

WIND VALUES

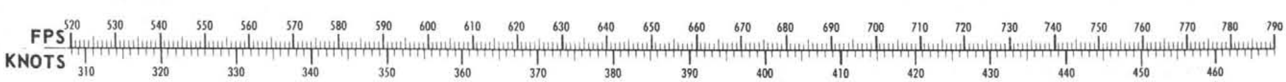


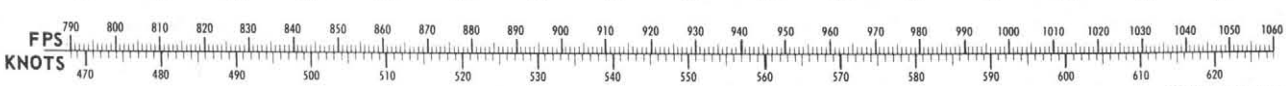
24. Forecast Wind Velocity . . . . ________ °True ________ knots

25. Relative Wind Velocity (fig 6-11) . . . . ________ ° ________ knots

26. Rangewind Component (head) (tail) . . . . ________ fps ________ knots

27. Crosswind Component (left) (right) . . . . ________ fps ________ knots





F4-34-VI-101-2

Figure 6-1 (Sheet 2 of 7)

(F-4C) (F-4D) (F-4E)

MISSION PLANNING FORM
NONNUCLEAR

DIVE AND LOW LEVEL BOMBING CONDITIONS (SINGLE) (RIPPLE)

* 28. (Ripple Rel) Release Alt of Last Bomb (Must be greater than #11) . . . . ______ feet
From Ripple Table or, #16 minus $[(I_R)\ (1.69)\ (V_R)\ (\sin\theta)\ (N-1)]$

29. Bomb Range (not required if ripple table is used).

a. First Bomb (fr. single table) . . . . ______ feet

b. Last Bomb (Interpolate table) . . . . ______ feet

30. Bomb Time of Flight

*a. First Bomb (fr. single or ripple table) . . . . ______ seconds

b. Last Bomb (interpolate table) . . . . ______ seconds

* 31. Ripple Pattern Length for ______ bombs from ripple table or, ... ______ feet
P.L. = $[(I_R)\ (1.69)\ (V_R)\ (\cos\theta)\ (N-1)] - \Delta R$

* 32. Range from First Release to Center of Ripple Pattern . . . . ______ feet
(fr. ripple table or, #29a plus one-half #31)

* 33. Sight Depression from Flight Path (fr. table or Sight Depression charts) . . . . . . ______ mils

34. Sight Setting (no wind) (#23 + #33) . . . . $\boxed{\quad\text{mils}}$

* 35. Headwind Correction Factor (Add) fr. table . . . . ______ mil/knot

* 36. Tailwind Correction Factor (Subtract) fr. table . . . . ______ mil/knot

* 37. Crosswind Correction Factor fr. table . . . . ______ ft/knot

38. Upwind Aimpoint (single point offset). . . . . ______ °True ______ feet
(Multiply #24 by #37)

39. Relative Wind Vector:
a. Rangewind Correction . . . . (+H) (-T) ______ feet, or (+H) (-T) ______ mils
(Multiply #26 by #35 or #36 and #37)
b. Crosswind Correction . . . . (left) (right) . . . . ______ feet
(Multiply #27 by #37)

40. Sight Setting Corrected for Rangewind (#34 ± #39a) . . . . $\boxed{\quad\text{mils}}$

41. Side Ejection Impact Distance (feet) and Release Sequence (if applicable) fig. 6-6:

IMPACT LEFT ⟵⟶ IMPACT RIGHT

STATION 2			
Sequence			
Error - ft.			

STATION 8			
Sequence			
Error - ft.			

STATION 1			
Sequence			
Sequence			
Error - ft.			

STATION 5			
Sequence			
Sequence			
Error - ft.			

STATION 9			
Sequence			
Sequence			
Error - ft.			

* Value can be obtained from Ripple Release Table.

F4-34-VI-101-3

Figure 6-1 (Sheet 3 of 7)

(F-4C) (F-4D) (F-4E)

Sheet 4 of 7

MISSION PLANNING FORM
NONNUCLEAR

ROCKET LAUNCH AND GUN FIRING CONDITIONS
Rocket Warhead Used: (MK-1) (MK-5, Heat) (Practice) (M151) (WDU-4A/A)

42. Time of Flight . . . . ________ seconds

43. Sight Setting (no wind) . . . . ________ mils

44. Slant Range . . . . ________ feet

45. Horizontal Range . . . . ________ feet

46. Wind Correction. . . . . ________ feet per knot

47. Wind Correction. . . . . ________ mils per knot

48. Upwind Aimpoint (single point offset) (Multiply #24 by #46) . . . ________ °True ________ feet

49. Relative Wind Vector:

a. Rangewind Correction (Multiply #26 by #47) (+H) (-T) . . . . ________ mils

b. Crosswind Correction (Multiple #27 by #46) (left) (right) . . . . ________ feet

50. Sight Setting Corrected for Rangewind (#43 ± #49a) (+H) (-T) . . . . $\boxed{\quad\quad\text{mils}}$

LOFT BOMBING RIPPLE RELEASE CONDITIONS

51. Approach Calibrated Airspeed . . . . ________ knots

52. Approach True Airspeed (fig 6-4) . . . . $\boxed{\quad\quad\text{fps,}\quad\quad\text{knots}}$

53. Approach Altitude AGL . . . . ________ feet

54. Indicated Approach Altitude MSL (Add: #8b, #21, #53) . . . . ________ feet

55. FIRST BOMB (from table):

a. Release Angle of First Bomb . . . . ________ degrees

b. LOW ANGLE Release Gyro Setting (table) . . . . $\boxed{\quad\quad\text{degrees}}$

c. Release Altitude AGL . . . . ________ feet

d. Time from Pullup to Release (t_b) . . . . ________ seconds

e. Range from Pullup to Impact ($R_2 + R_3$) . . . . ________ feet

f. Time from Release to Impact (t_c) (check #11c) . . . . ________ seconds

56. Time Required to Ripple ____ Bombs at ________ msec Interval . . . . ________ seconds
(Multiply Interval Setting by number of bombs, minus one bomb).

F4-34-VI-101-4

Figure 6-1 (Sheet 4 of 7)

(F-4C) (F-4D) (F-4E) Sheet 5 of 7

MISSION PLANNING FORM
NONNUCLEAR

57. LAST BOMB:

a. Time from Pullup to Release, t_b, (#56 + #55d). . . . . ________ seconds

b. Release Angle (Obtained from the line that provides #57a) . . . . ________ degrees

c. Release Altitude AGL . . . . ________ feet

d. Range from Pullup to Impact ($R_2 + R_3$) . . . . ________ feet

e. Time from Release to Impact (t_c)(check #11c) . . . . ________ seconds

58. Approx. Pattern Length (#57d minus #55e) . . . . [ ] feet

59. Approx. Range from Pullup to Center of Pattern (#55e plus one-half #58). . . . . ________ feet

60. IP-to-Target Distance (from map or photos). . . . . ________ feet

61. IP-to-Pullup Distance (#60 minus #59) . . . . [ ] feet

62. Pullup Timer Setting (#61 ÷ #52 fps). . . . . [ ] seconds

63. RANGEWIND CORRECTION:

a. Aircraft ground speed (#52 ± #26). . . . . ________ fps

b. R_2 and R_3 Wind Correction Time (fig 6-19) or: . . . . (+H) (-T) ________ seconds
[(#57a + #57e) times (#26 fps)] ÷ #63a .

c. Ground speed IP-to-Pullup Time (#61 ÷ #63a) . . . . ________ seconds

d. Pullup Timer Setting, Rangewind Corrected (#63c ± 63b) . . . . [ ] seconds

64. WRCS LABS/TGT FIND CORRECTIONS:

a. Pullup Timer Lead-in Time Desired
(Minimum Pullup Timer Setting is 0.1 sec.) . . . . [ ] seconds

b. Aircraft ground speed (#52 ± #26) . . . . ________ fps

c. Pullup Timer Setting Converted to Distance
(#64a) times (#64b) . . . . (+) ________ feet

d. $R_2 + R_3$ Wind Correction Distance (head)(tail)
(#57a + #57e) times (#26 fps) . . . . (-H,+T) ________ feet

e. Release Range (R_R) Setting
(#59 + #64c ± 64d). . . . . [ ] feet

F4-34-VI-101-5

Figure 6-1 (Sheet 5 of 7)

(F-4D) (F-4E) | Sheet 6 of 7

* This form is classified CONFIDENTIAL when Item #76 or #77 is filled in for the CBU-24, -29, -49.

MISSION PLANNING FORM
NONNUCLEAR

DIVE TOSS BOMBING (From Dive Toss Bombing Table)

NOTE: Complete sheet 1 and WIND VALUES on sheet 2. When the pickle slant range is 10,000 feet or greater, Safe Escape and Dive Recovery computations are not required. Check #75 with #11b.

65. Release Calibrated Airspeed . . . . ____________ knots.
66. Release True Airspeed (figure 6-4) . . . . ____________ knots.
67. Dive Angle of Pickle . . . . ____________ degrees.
68. Slant Range of Pickle . . . . ____________ feet.
69. Pullout Acceleration (2.0)(3.0)(4.0) . . . . ____________ G's.
70. Pickle Altitude AGL . . . . ____________ feet.
71. Ripple Release Interval (0.06)(0.10)(0.14). . . . . ____________ seconds.
72. Time from Pickle to middle bomb release . . . . ____________ seconds.
73. Release Altitude AGL of middle bomb . . . . ____________ feet.
74. Release Angle of middle bomb (+ above, - below horz). . . . . . . ____________ degrees.
75. Time of fall of middle bomb . . . . ____________ seconds.

Note

Determine last bomb time fall and check #11b is LESS.

* 76. Stick length of (3) (6) (8) (12) bomb ripple. . . . . ____________ feet.

* 77. Stick length of less than _____ bomb ripple
(#76 ÷ N)times (N-1) . . . . ____________ feet.

78. (CBU-24, -29) M907 Fuze Setting . . . . ____________ seconds.

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Figure 6-1 (Sheet 6 of 7)

(F-4D) (F-4E) Sheet 7 of 7

MISSION PLANNING FORM NONNUCLEAR

WRCS COUNTER SETTINGS

79. Dive Toss Mode:

a. Drag Coefficient (fig 6-17).		
b. Release Advance (#19 x $\frac{N-1}{2}$)		MSEC
c. Pickle Slant Range (fig 6-17, or #68)	______	feet

80. Dive Laydown Mode:

a. Release Range (#29a or #32).		FT x 10 FT x 100
b. Release Advance (#19 x $\frac{N-1}{2}$).		MSEC

81. Laydown Mode:

a. Alt/ RANGE (IP-to-target).		FT x 100
b. Release Range (#29a or #32).		FT x 10 FT x 100
c. Release Advance (#19 x $\frac{N-1}{2}$)		MSEC
d. Sight Depression from Level Flight Path for IP Range to Target (fr. fig 6-10).		MILS

82. Offset Bombing or Target Finding Mode:

a. ALT/Range (#8d or IP Pressure Alt.).		FT x 100
b. N-S Target Distance (fr. map) . . . . (N) (S)		FT x 100
c. E-W Target Distance (fr. map). . . . . (E) (W)		FT x 100
d. (OFFSET BOMB) Release Range (#29a or #32).		FT x 10 FT x 100
e. (OFFSET BOMB) Release Advance (#19 x $\frac{N-1}{2}$)		MSEC

83. LABS/TGT Find Mode:

a. ALT./Range (#8d or IP Pressure Alt.)		FT x 100
b. N-S Target Distance (fr. map) . . . . (N) (S)		FT x 100
c. E-W Target Distance (fr. map). . . . . (E) (W)		FT x 100
d. Release Range (#64e)		FT x 10 FT x 100
e. Sight Depression from Level Flight Path		MILS

F4-34-VI-101-7

Figure 6-1 (Sheet 7 of 7)

DIVE RECOVERY CHART

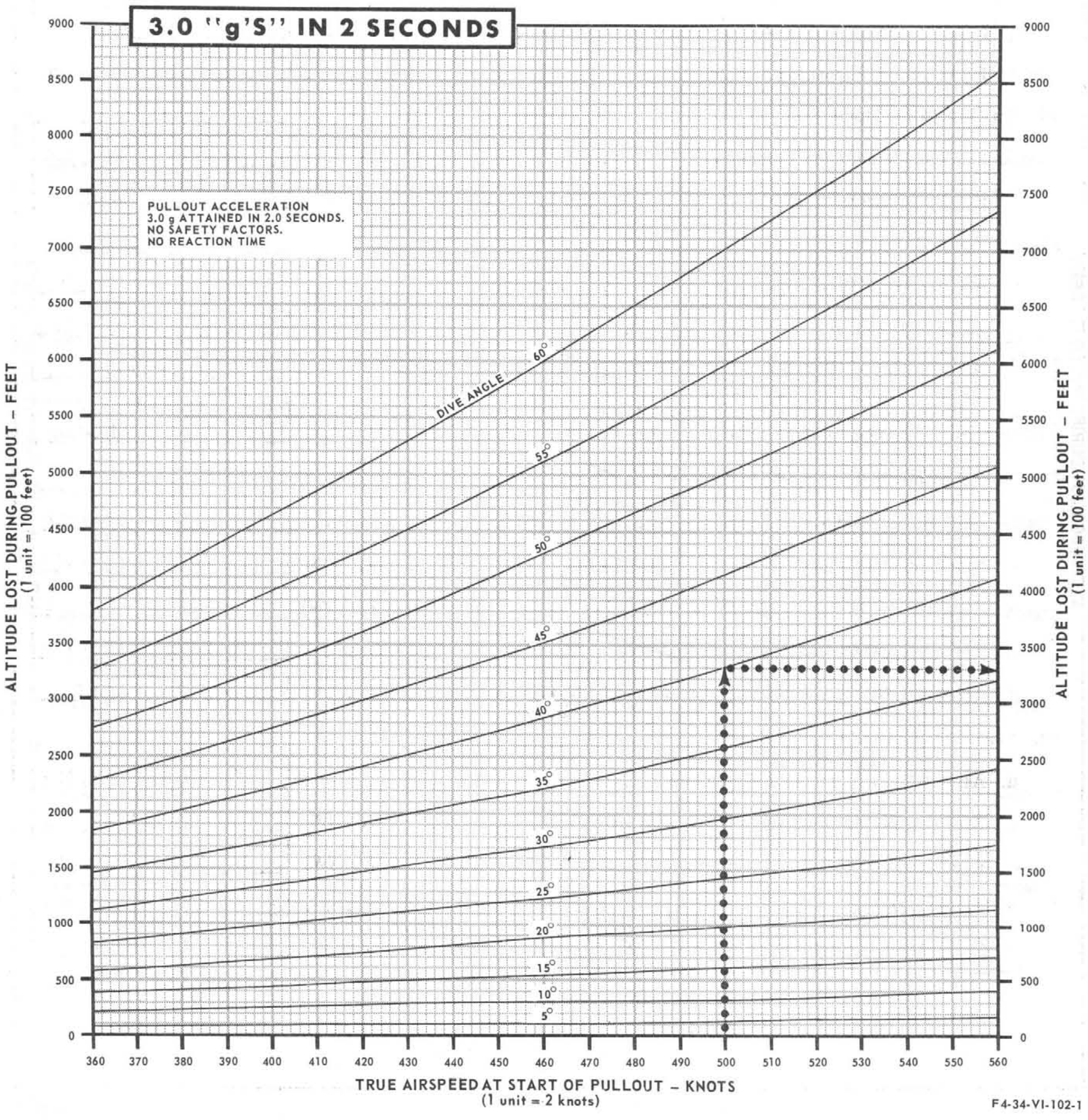


Figure 6-2 (Sheet 1 of 4)

DIVE RECOVERY CHART

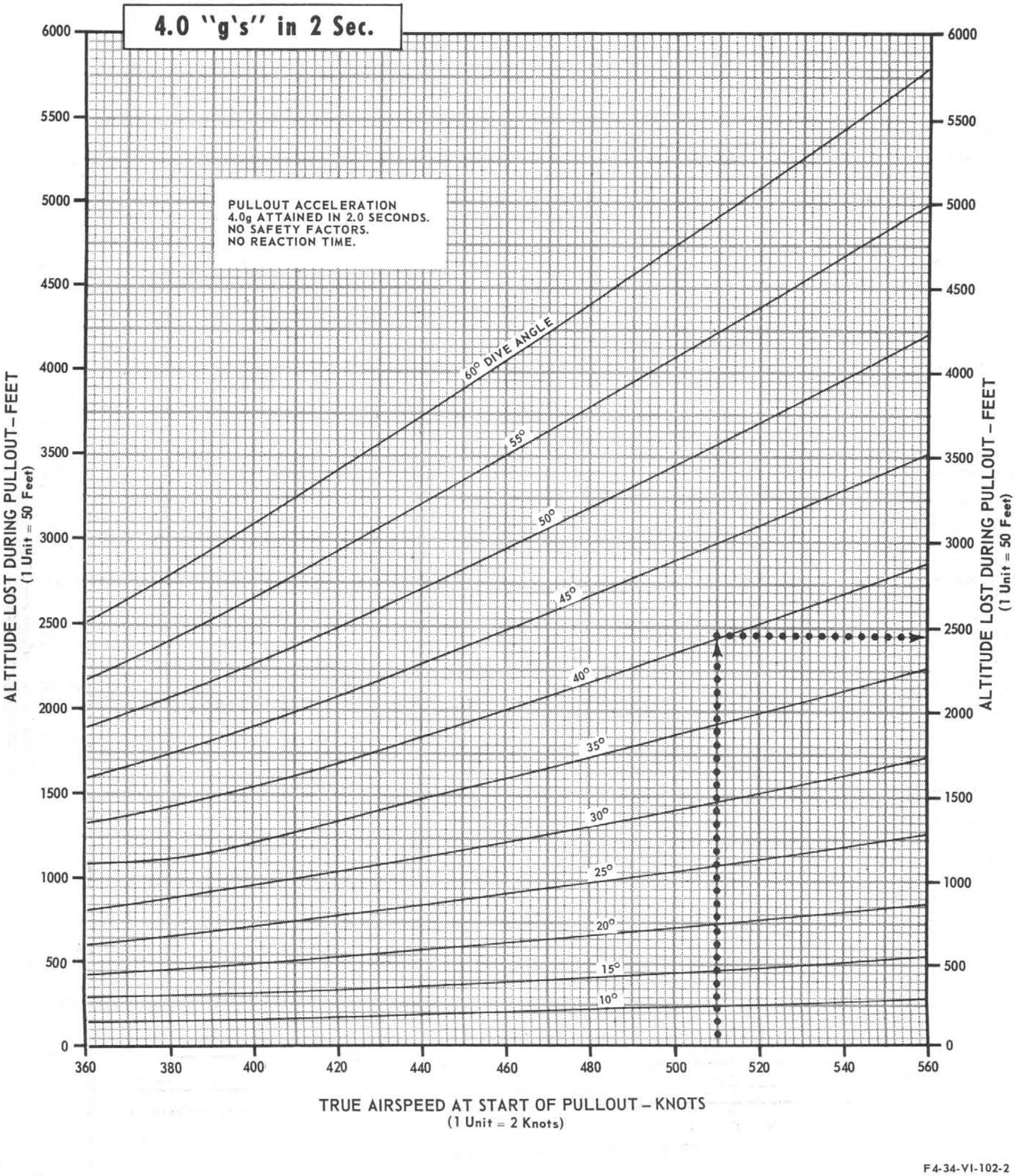


Figure 6-2 (Sheet 2 of 4)

DIVE RECOVERY CHART

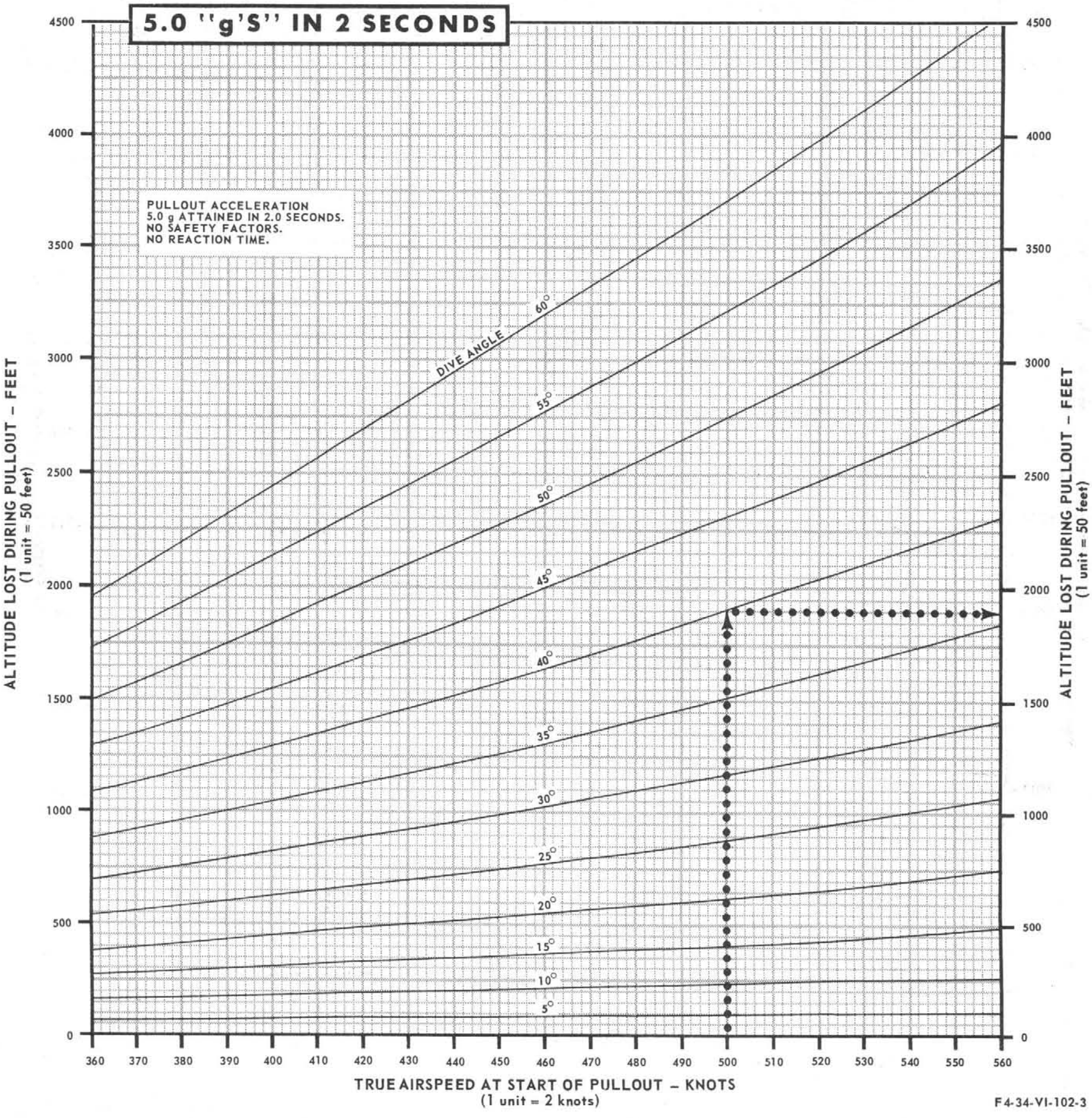


Figure 6-2 (Sheet 3 of 4)

DIVE RECOVERY CHART

BANKED TURN PULLOUT

ALTITUDE LOSS DURING 4.0 G PULLUP RECOVERY FOR A BANKED TURN PULLOUT

15° DIVE

KNOTS TAS	WINGS LEVEL	10° BANK	20° BANK	30° BANK	45° BANK
450	390	390	410	420	470
500	460	460	480	500	570
550	540	540	560	580	670
600	620	620	640	670	780

30° DIVE

KNOTS TAS	WINGS LEVEL	10° BANK	20° BANK	30° BANK	45° BANK
450	1200	1210	1260	1340	1610
500	1440	1450	1510	1620	1970
550	1690	1710	1780	1920	2350
600	1960	1990	2070	2230	2740

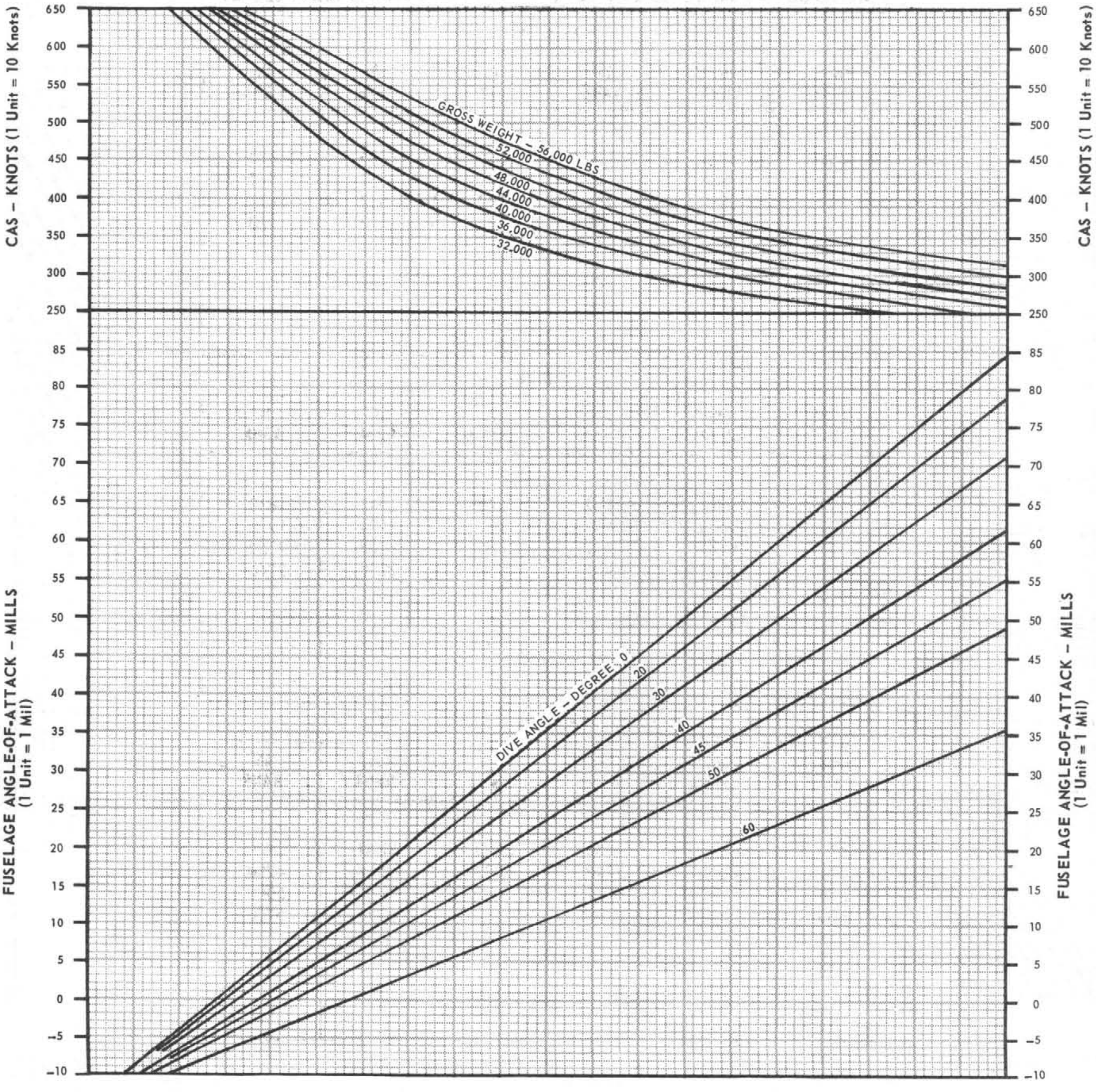
45° DIVE

KNOTS TAS	WINGS LEVEL	10° BANK	20° BANK	30° BANK	45° BANK
450	2390	2430	2530	2740	3420
500	2900	2940	3080	3340	4200
550	3430	3480	3650	3970	5000
600	3960	4020	4210	4580	5750

F4-34-VI-102-4

Figure 6-2 (Sheet 4 of 4)

ANGLE OF ATTACK



F4-34-VI-103

Figure 6-3

AIRSPEED CONVERSION CHART

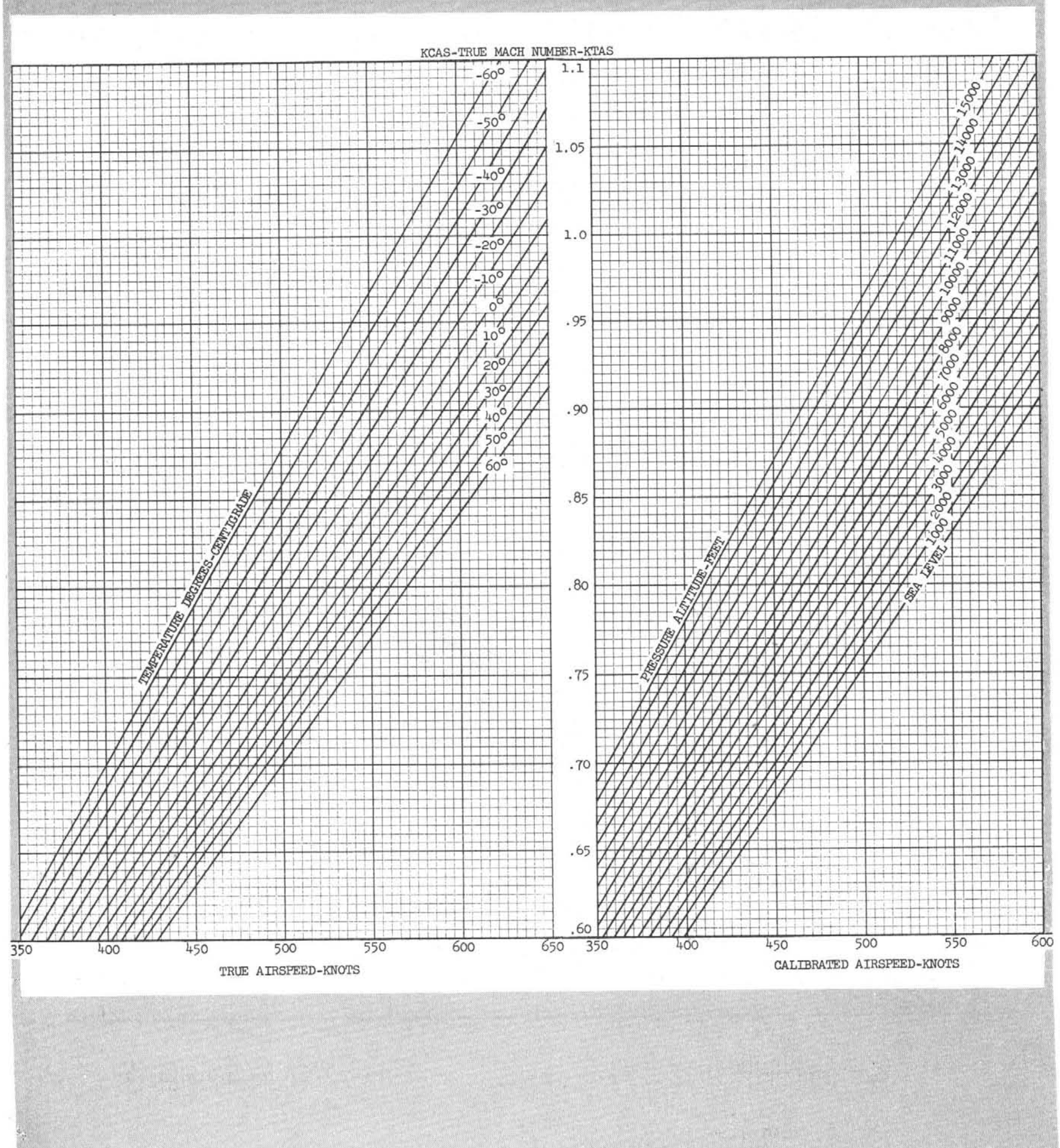


Figure 6-4

ALTITUDE CONVERSION

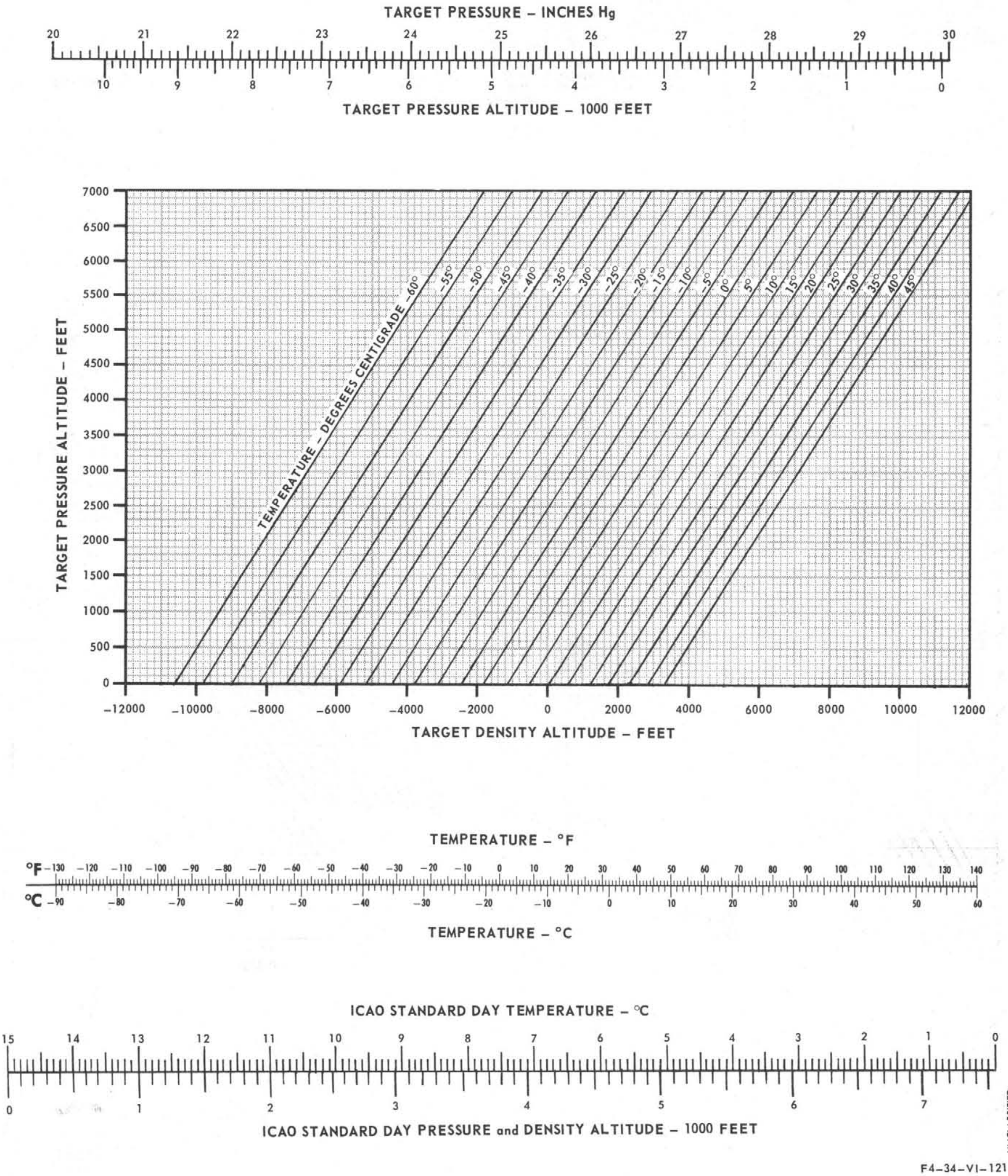


Figure 6-5

SIDE EJECTION IMPACT DISTANCE

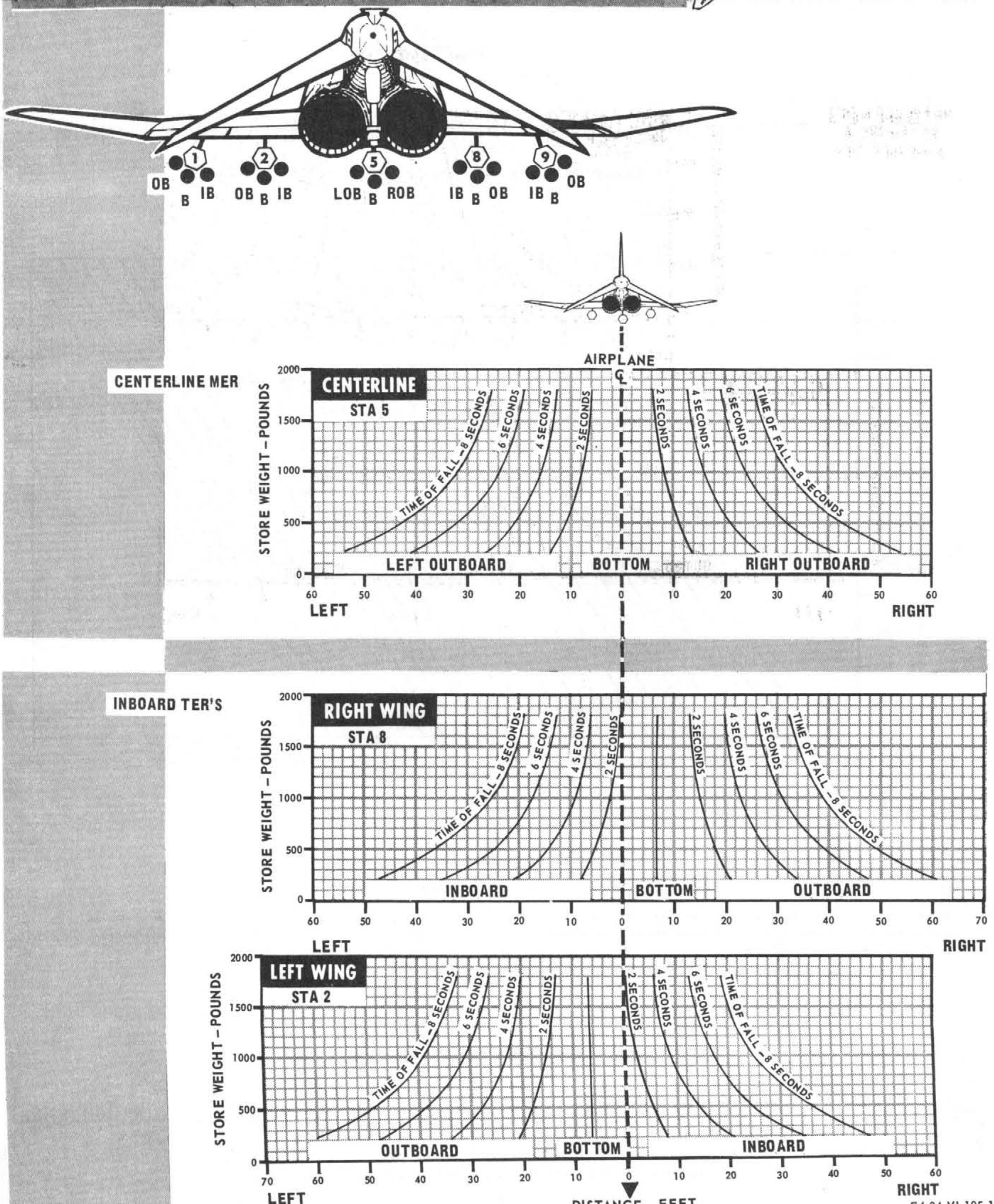


Figure 6-6 (Sheet 1 of 2)

OUTBOARD MER'S on MAU-12B/A Armament Pylons

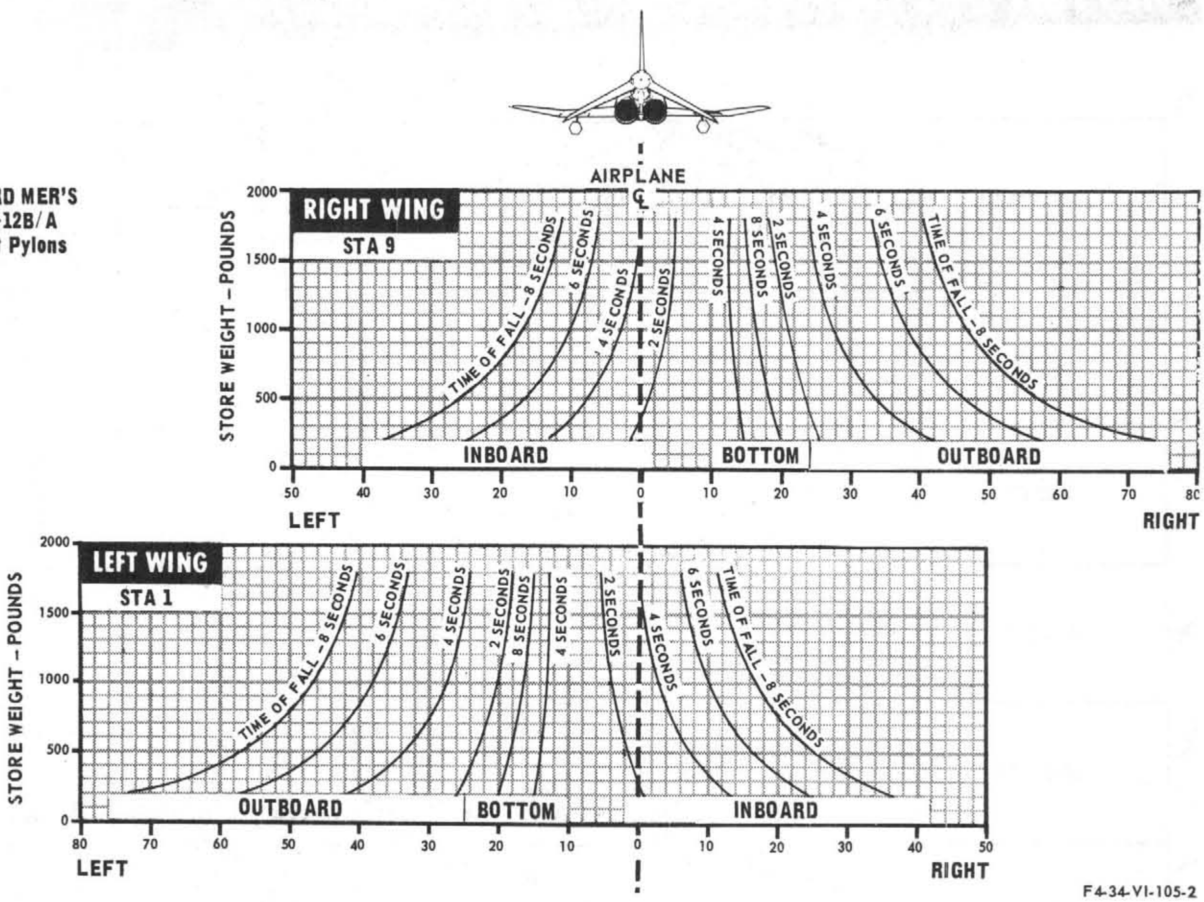


Figure 6-6 (Sheet 2 of 2)

ALTITMETER POSITION ERROR CORRECTION F-4C F-4D

ALTITUDE	VELOCITY KCAS	ΔH CORRECTION – FEET		
		GROSS WT 36,000 LBS	GROSS WT 40,000 LBS	GROSS WT 45,000 LBS
SEA LEVEL	400	-150	-130	-120
	450			-160
	500			-140
	550			-140
	600			-110
3000 FT	400	-190	-170	-150
	450			-200
	500			-80
	550			-80
	600			-350
5000 FT	400	-230	-200	-180
	450			-150
	500			-60
	550			-110
	600			-440
10,000 FT	400	-280	-250	-220
	450	-170	-150	-130
	500	-110	-100	-90
	550	-600	-500	-440
	600	-490	-430	-380
15,000 FT	400	-170	-150	-130
	450	-135	-120	-110
	500	-490	-430	-380
	550	-0	-0	-0
	600	-600	-500	-440
20,000 FT	400	-110	-100	-90
	450	-490	-430	-380
	500	-0	-0	-0
	550	-600	-500	-440
	600	-820	-720	-630
25,000 FT	400	-280	-250	-220
	450	-0	-0	-0
	500	-600	-500	-440
	550	-820	-720	-630
	600	-620	-520	-460

EFFECTIVITY:
(1.) F-4C BEFORE T.O. 1F-4-754.
(2.) F-4D-24 THRU 28 PRIOR TO T.O. 1F-4-754.

SAMPLE:
ASSIGNED ALTITUDE: 1000 FEET
AIRSPEED: 500 KCAS
GROSS WEIGHT: 36,000 POUNDS

FLY:
1000 FEET - 150 FEET, OR 850 FEET INDICATED ALTITUDE

Notes

- AFTER T.O. 1F-4-754 THE ERROR BECOMES ZERO ± ANY ERROR NOTED DURING ALTIMETER PREFLIGHT.
- FOR F-4E AIRCRAFT, THE ERROR IS ZERO ± ANY ERROR NOTED DURING ALTIMETER PREFLIGHT.

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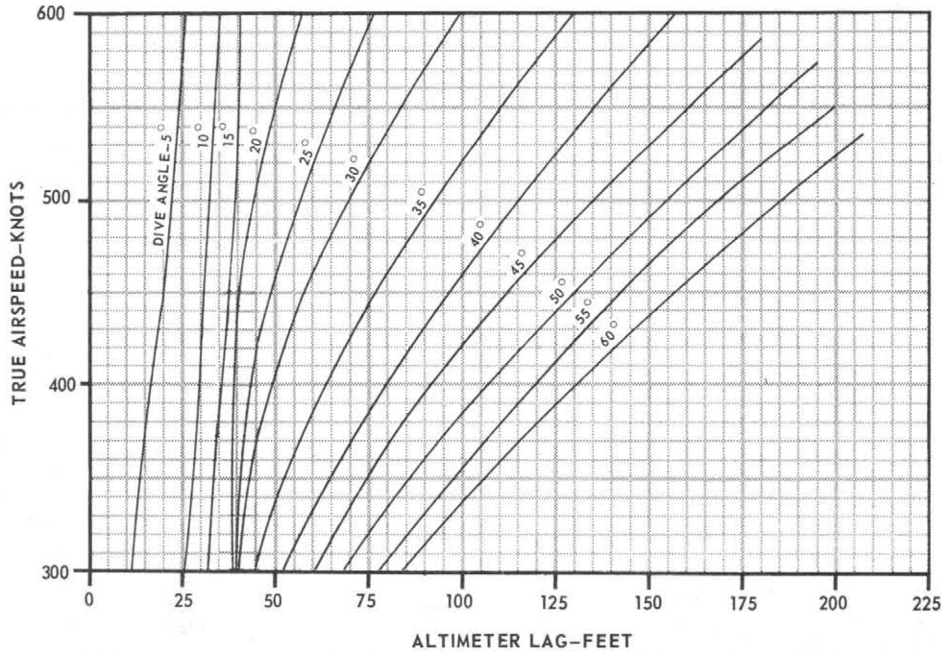
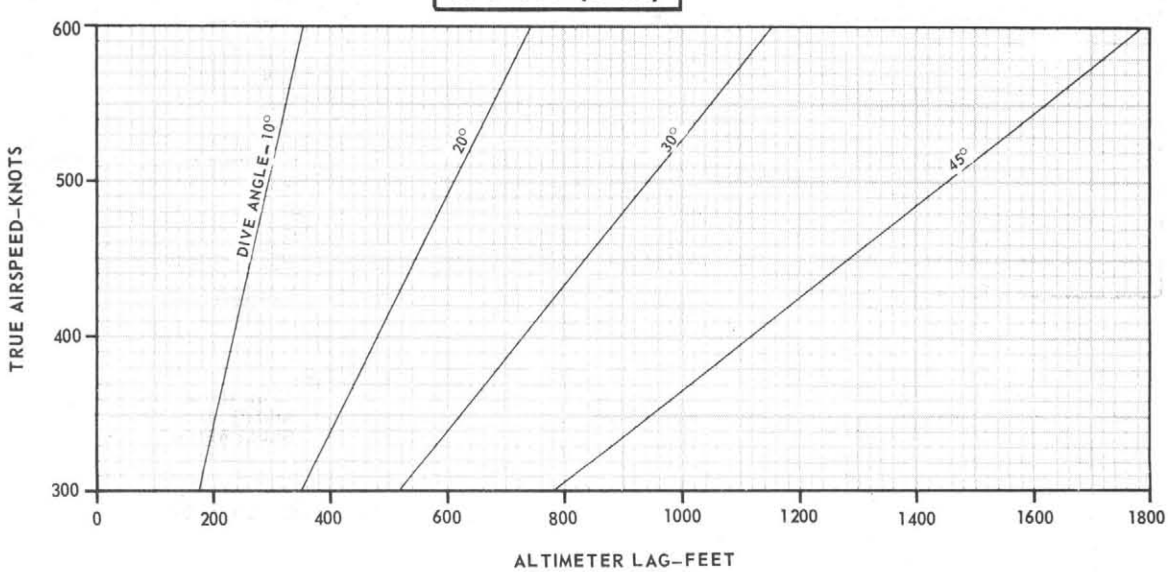
NEW Figure 6-7

ALTIMETER LAG

SPC ON (F-4C/D/E)



SPC OFF (F-4E)



F4-34-VI-106-1

Figure 6-8 (Sheet 1 of 2)

ALTIMETER LAG (continued)

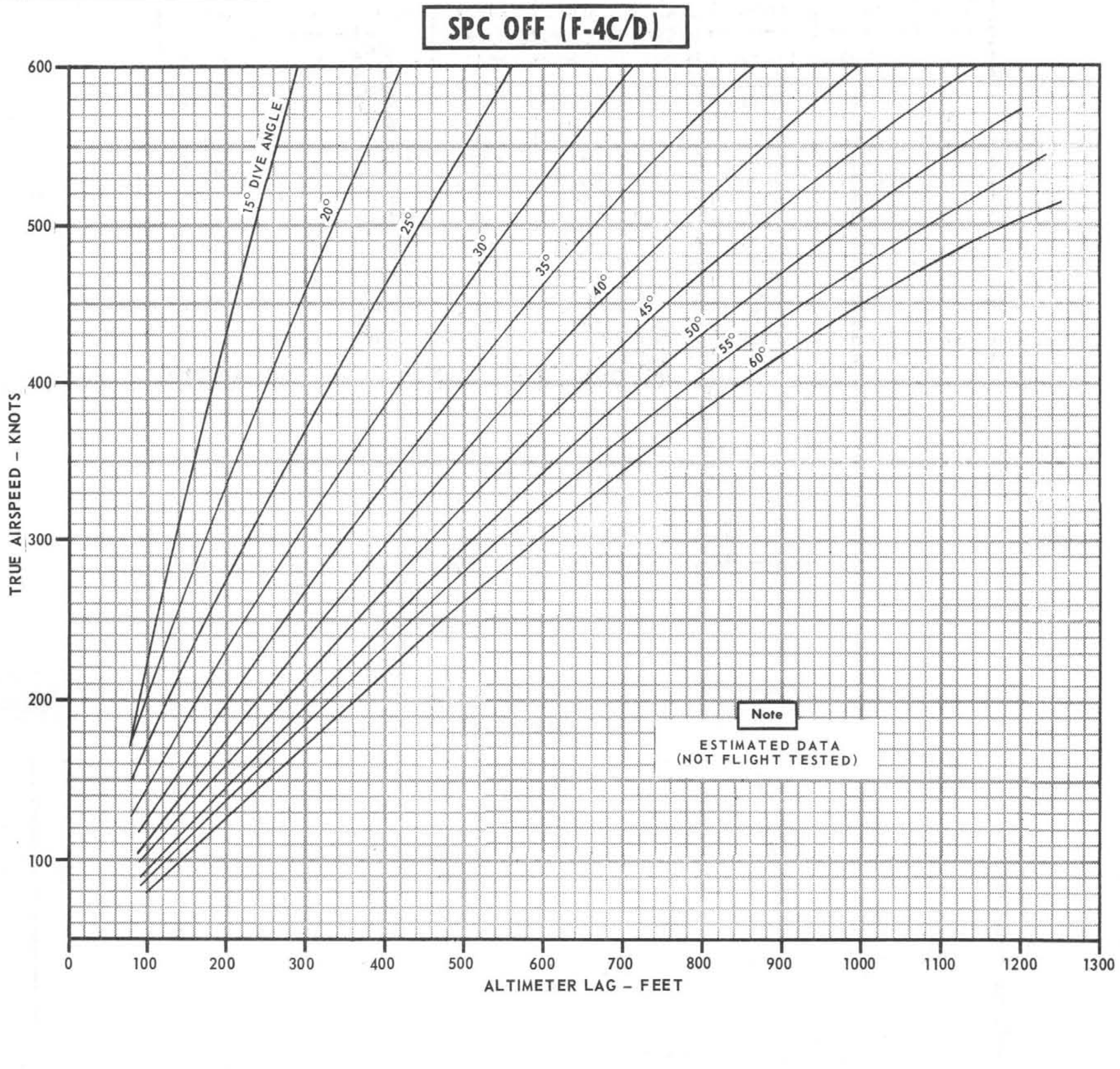


Figure 6-8 (Sheet 2 of 2)

SINE and COSINE TABLE

Dive Angle	sine	cosine	Dive Angle		sine	cosine	Dive Angle		sine	cosine
0	.00000	1.00000	16		.27564	.96126	32	58	.52992	.84805
1	.01745	.99985	17		.29237	.95630	33	57	.54464	.83867
2	.03490	.99939	18		.30902	.95106	34	56	.55919	.82904
3	.05234	.99863	19		.32557	.94552	35	55	.57358	.81915
4	.06976	.99756	20		.34202	.93969	36	54	.58779	.80902
5	.08716	.99619	21		.35837	.93358	37	53	.60182	.79864
6	.10453	.99452	22		.37461	.92718	38	52	.61566	.78801
7	.12187	.99255	23		.39073	.92050	39	51	.62932	.77715
8	.13917	.99027	24		.40674	.91355	40	50	.64279	.76604
9	.15643	.98769	25		.42262	.90631	41	49	.65606	.75471
10	.17365	.98481	26		.43837	.89879	42	48	.66913	.74314
11	.19081	.98163	27		.45399	.89101	43	47	.68200	.73135
12	.20791	.97815	28		.46947	.88295	44	46	.69466	.71934
13	.22495	.97437	29		.48481	.87462	45	45	.70711	.70711
14	.24192	.97030	30	60	.50000	.86603				
15	.25882	.96593	31	59	.51504	.85717				
					COSINE	SINE			COSINE	SINE

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Figure 6-9

SIGHT DEPRESSION

LEVEL FLIGHT

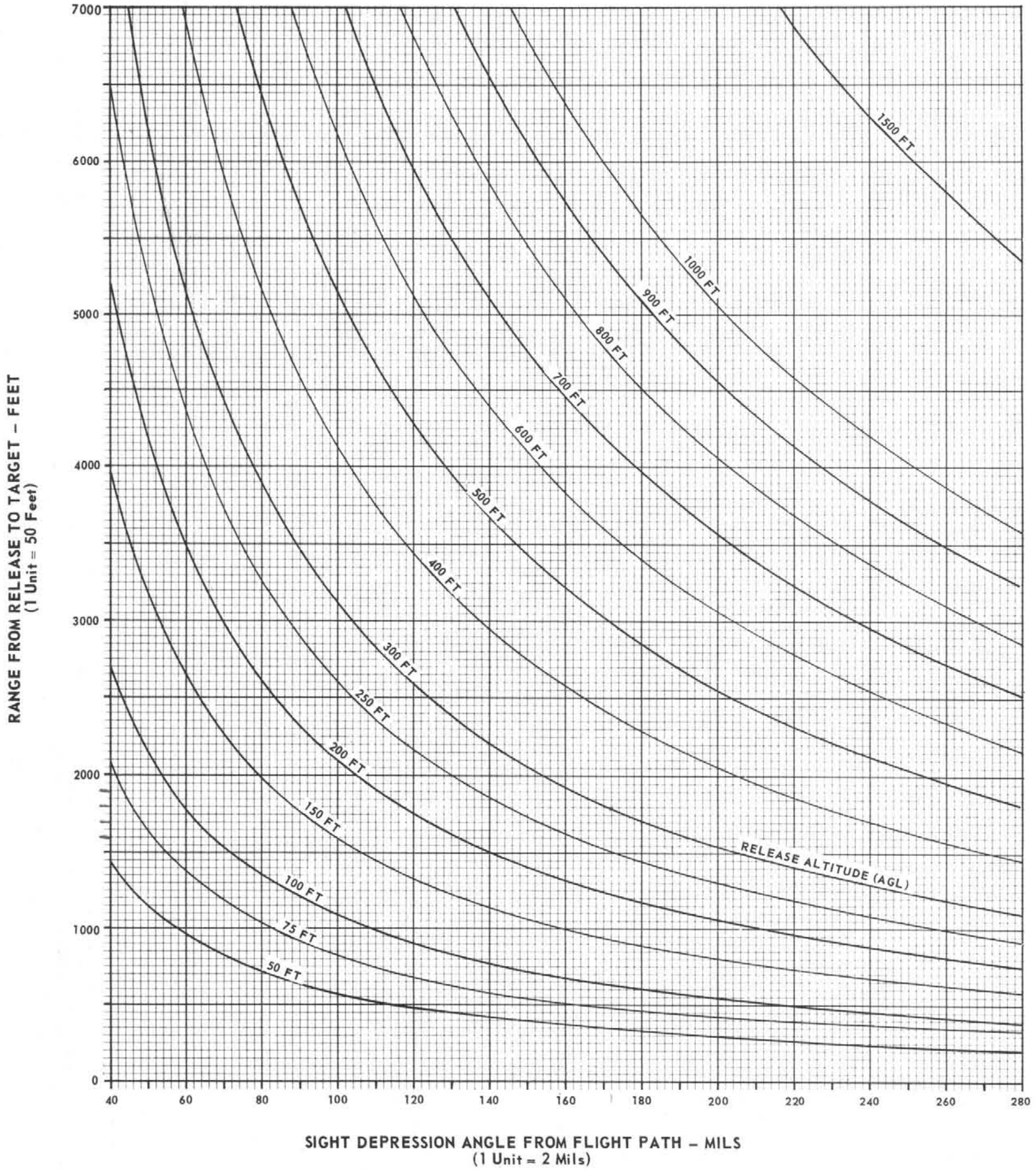


Figure 6-10 (Sheet 1 of 14)

SIGHT DEPRESSION

LEVEL FLIGHT

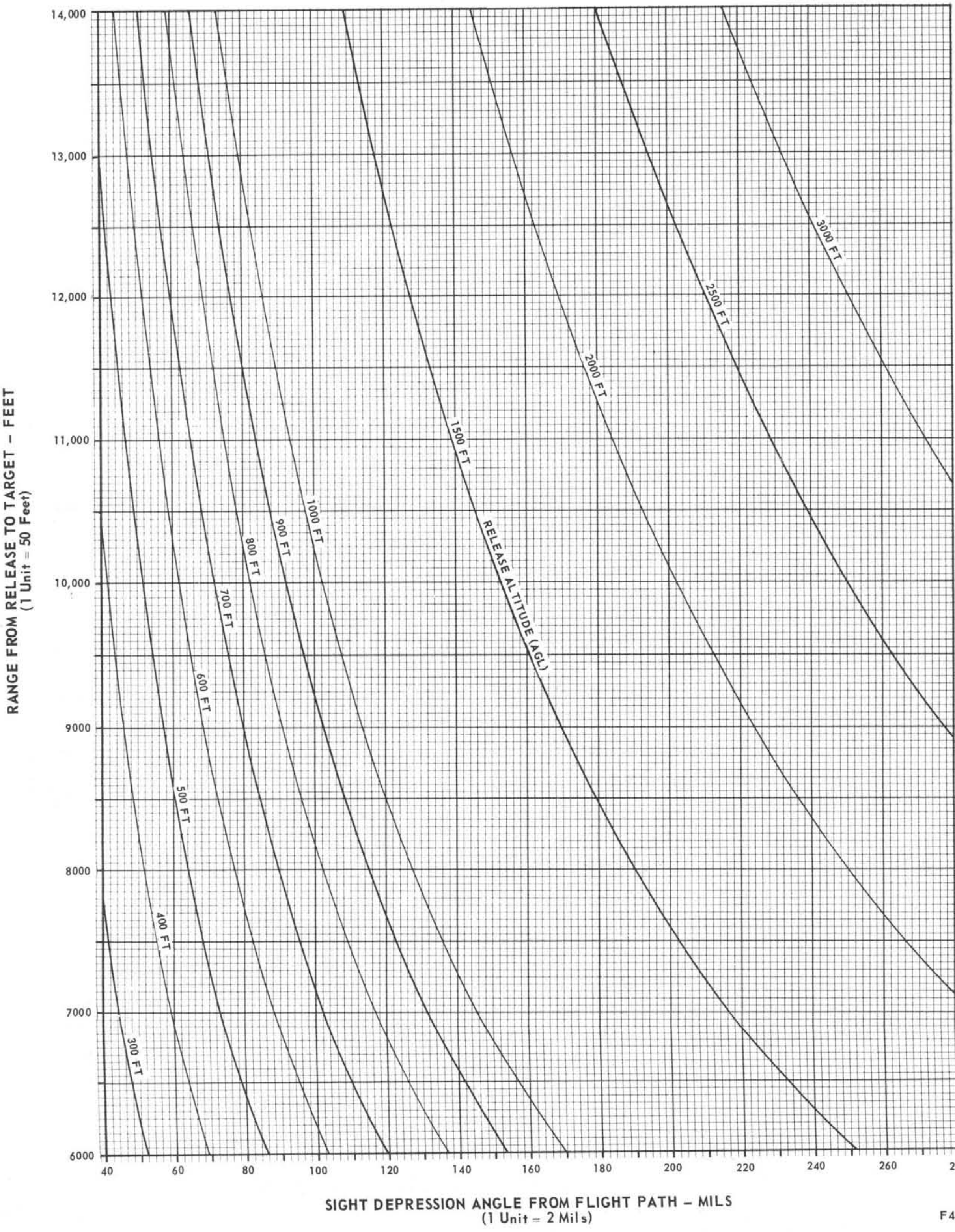


Figure 6-10 (Sheet 2 of 14)

SIGHT DEPRESSION

5° DIVE

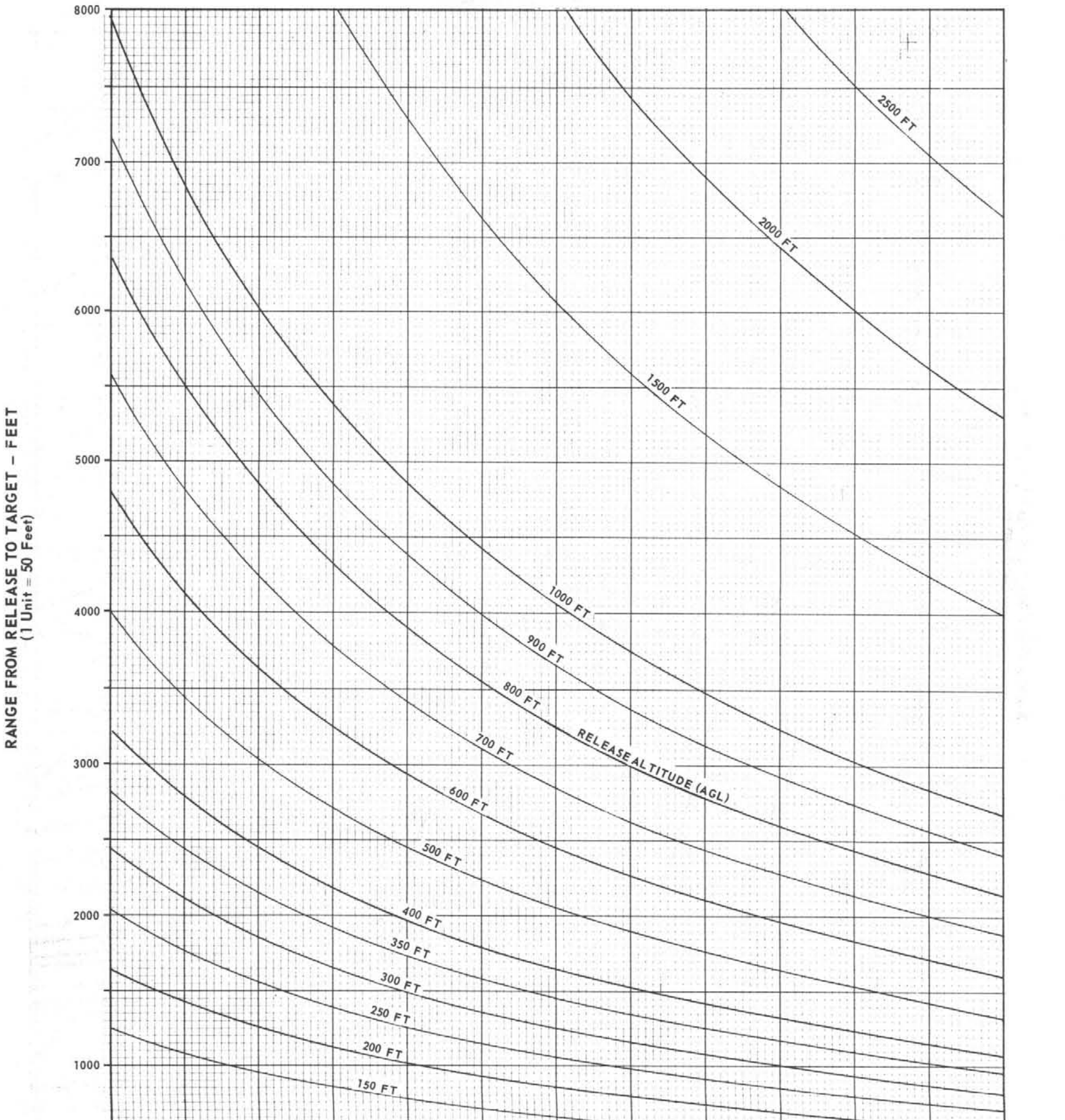


Figure 6-10 (Sheet 3 of 14)

SIGHT DEPRESSION

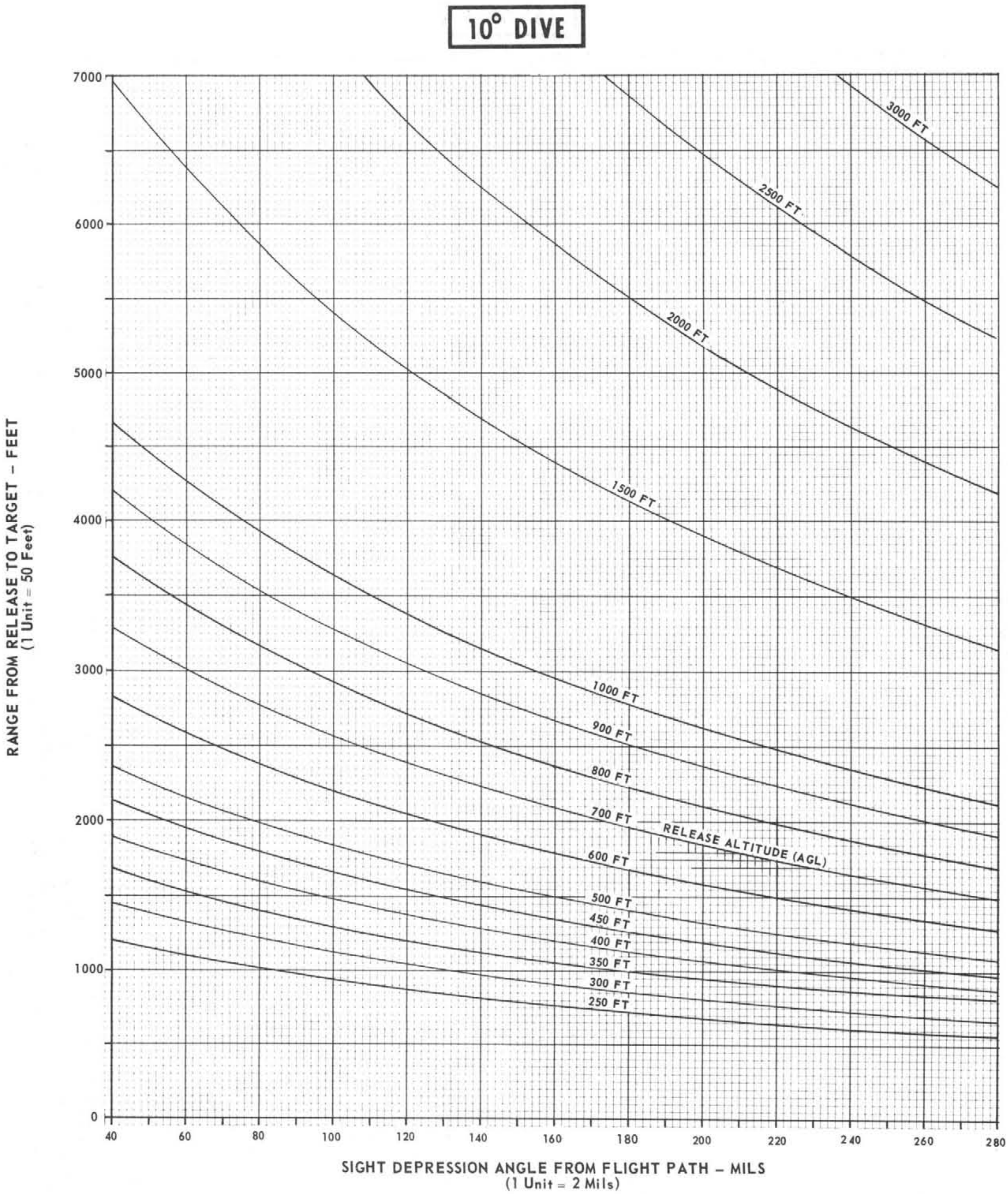


Figure 6-10 (Sheet 4 of 14)

SIGHT DEPRESSION

15° DIVE

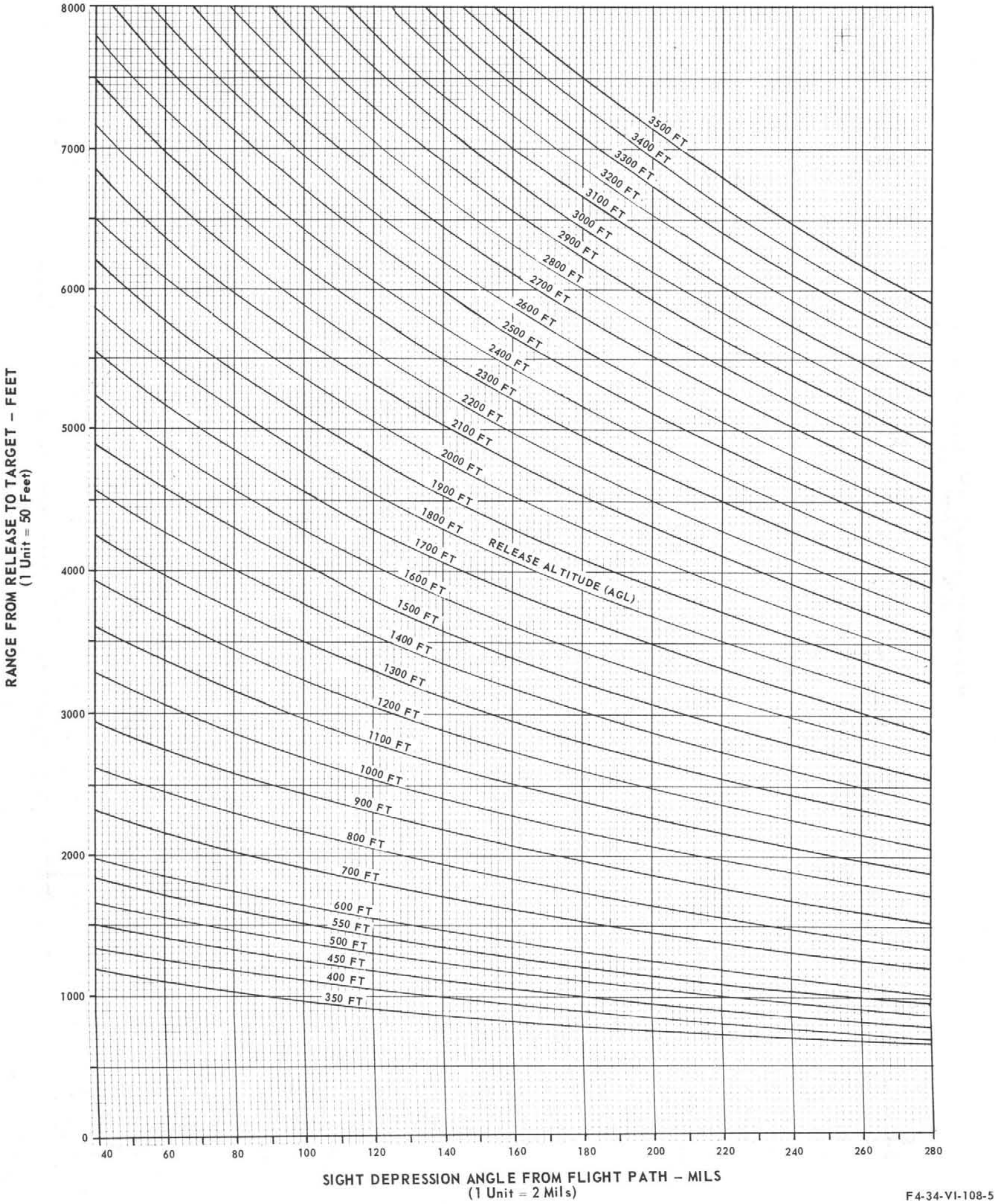


Figure 6-10 (Sheet 5 of 14)

SIGHT DEPRESSION

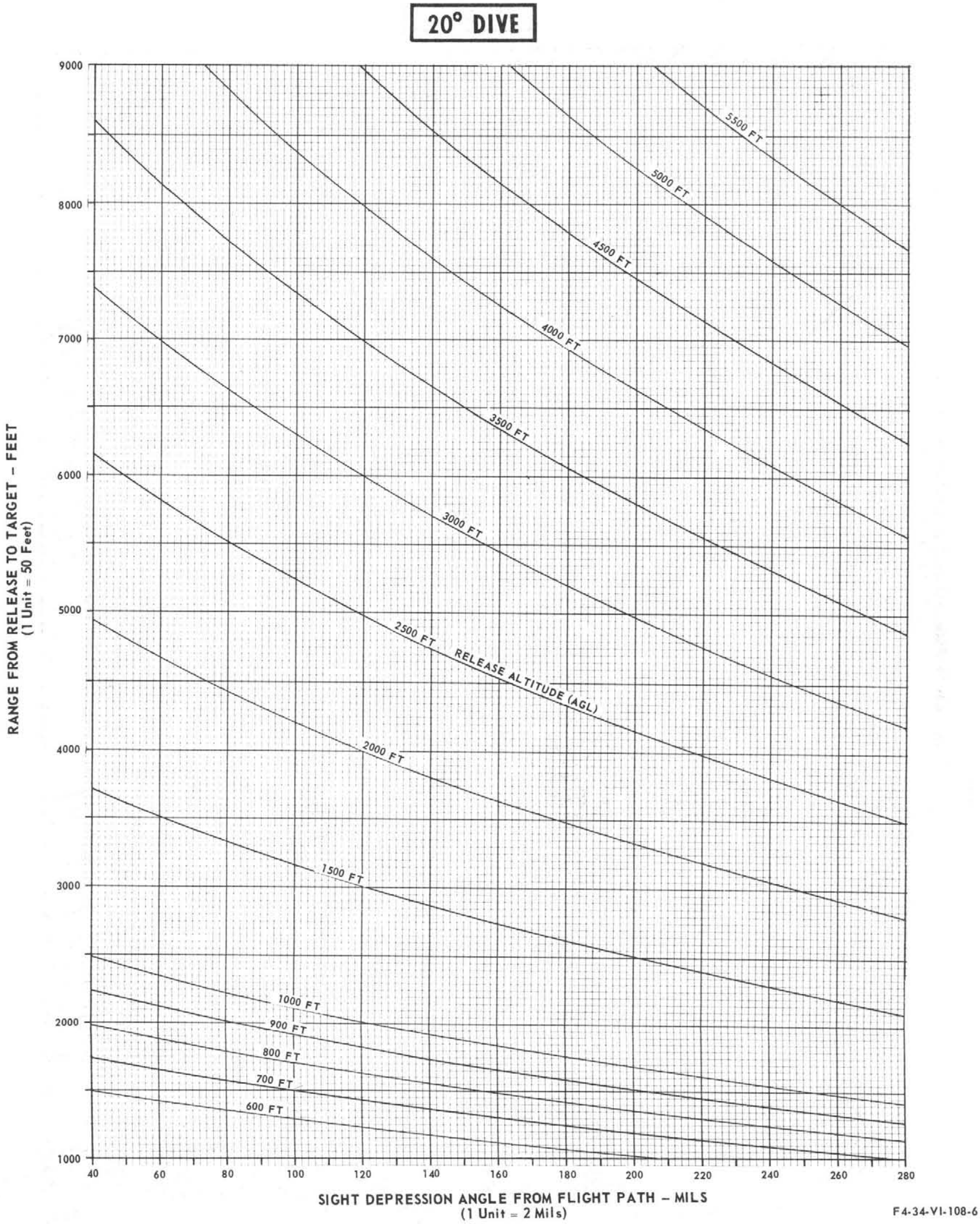


Figure 6-10 (Sheet 6 of 14)

SIGHT DEPRESSION

25° DIVE

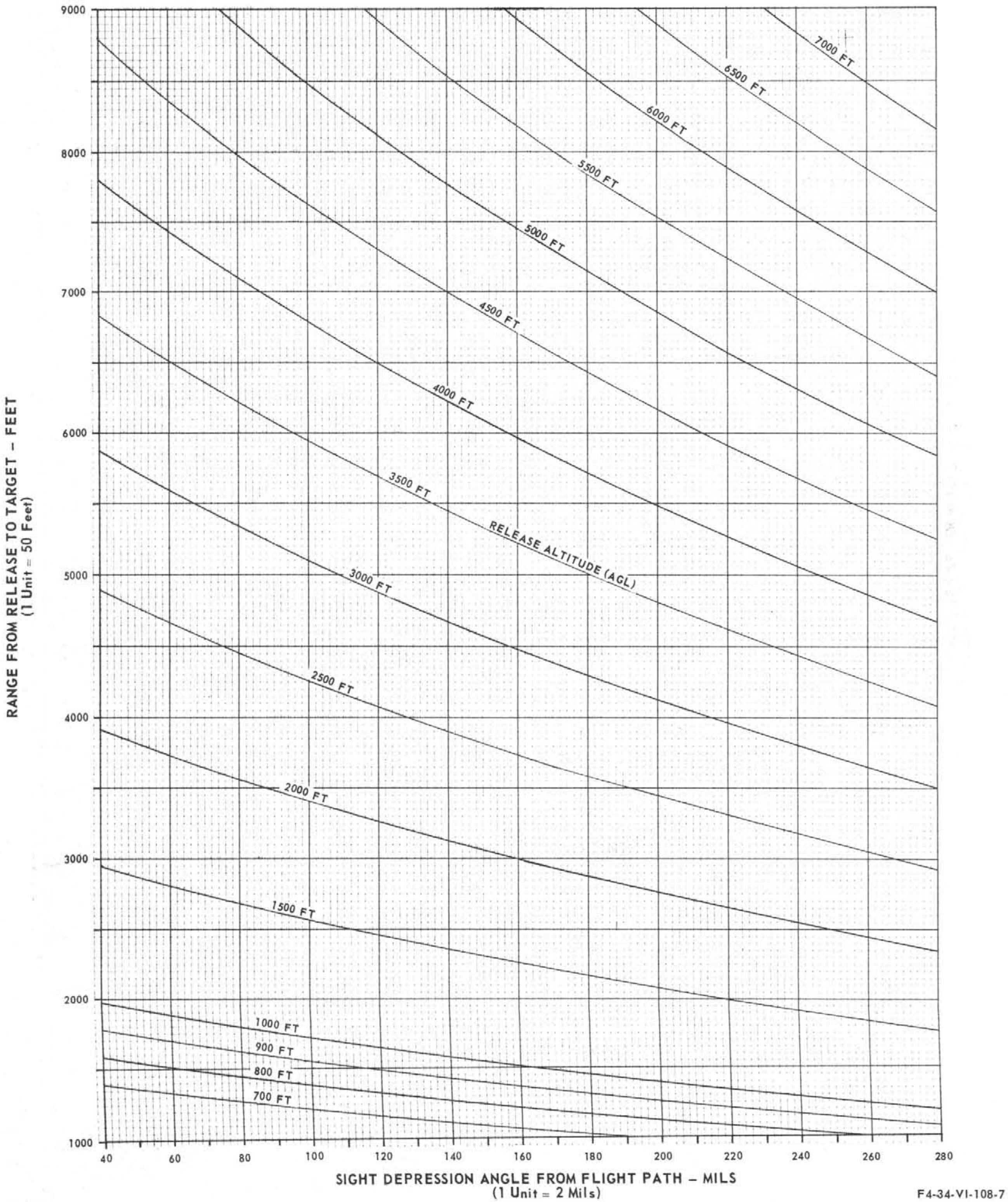
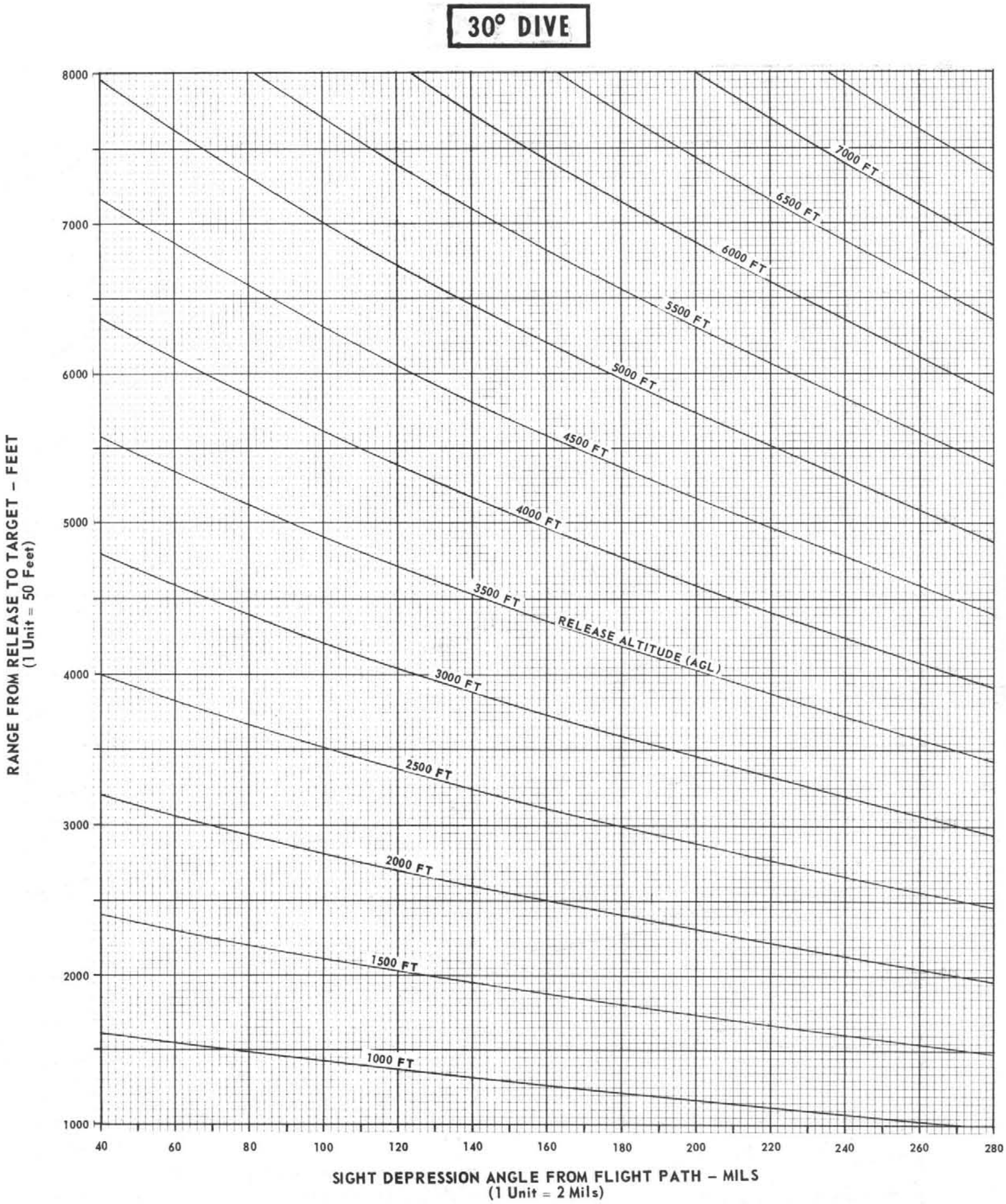


Figure 6-10 (Sheet 7 of 14)

SIGHT DEPRESSION



F4-34-VI-108-8

Figure 6-10 (Sheet 8 of 14)

SIGHT DEPRESSION

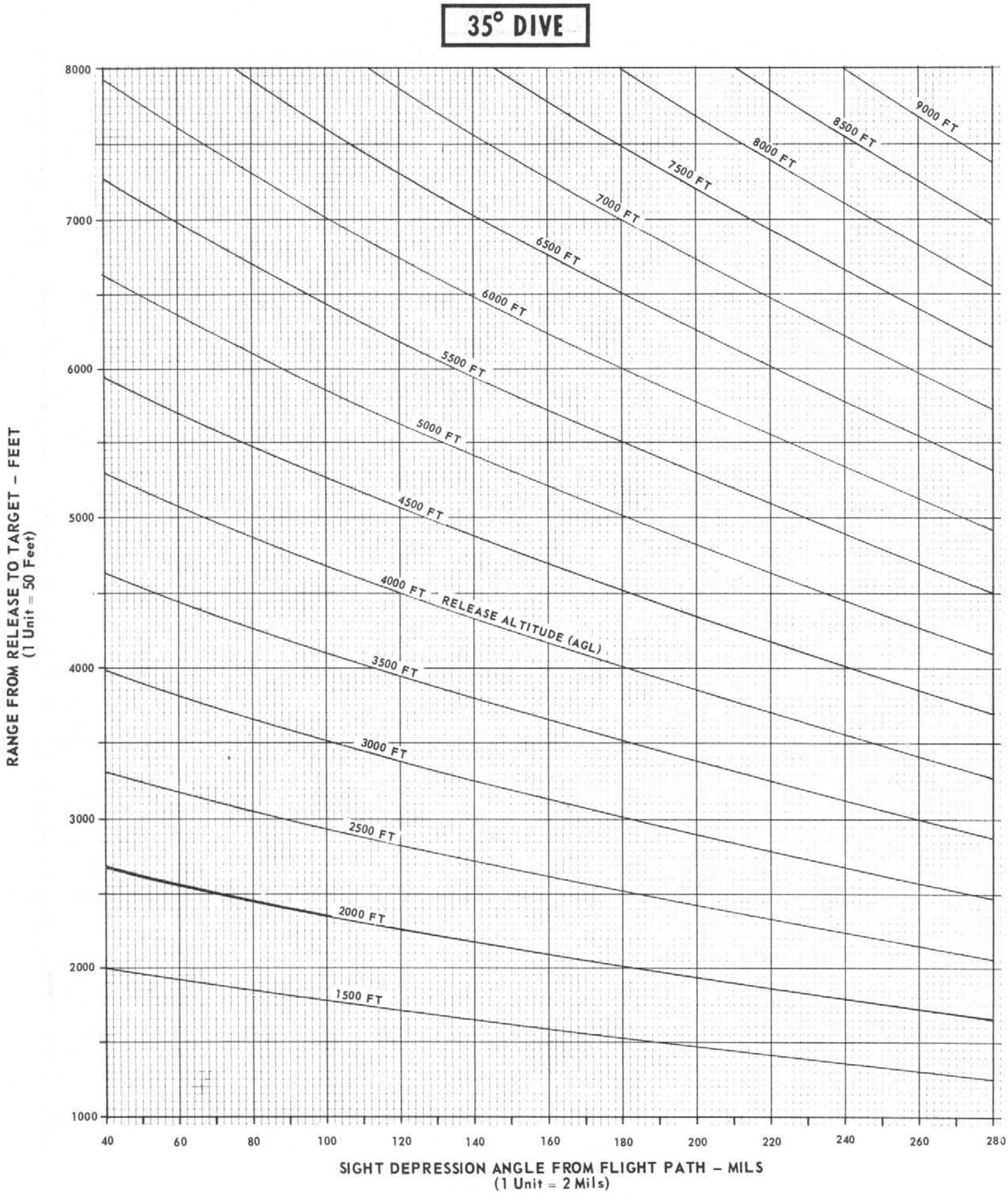
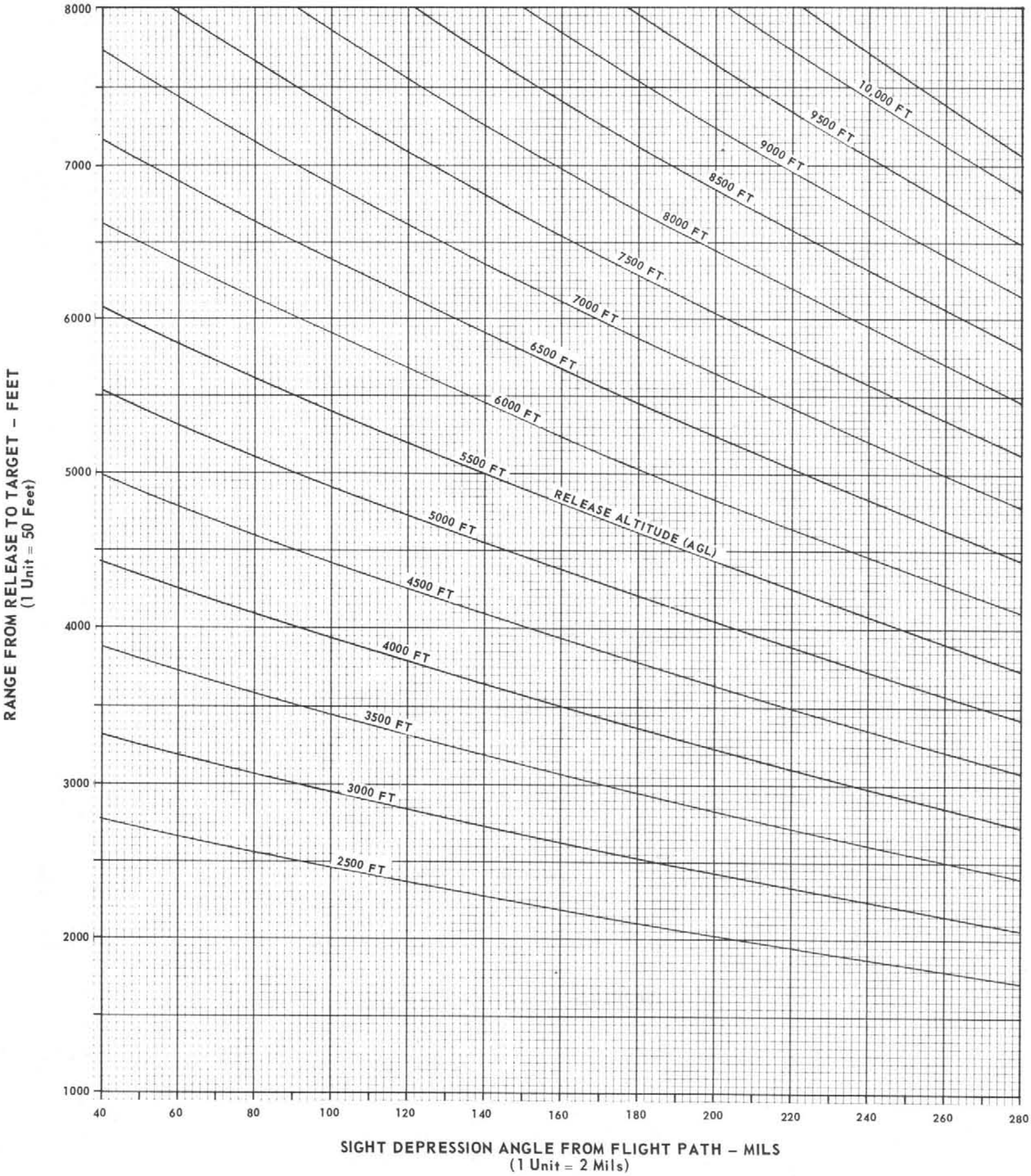


Figure 6-10 (Sheet 9 of 14)

SIGHT DEPRESSION

40° DIVE

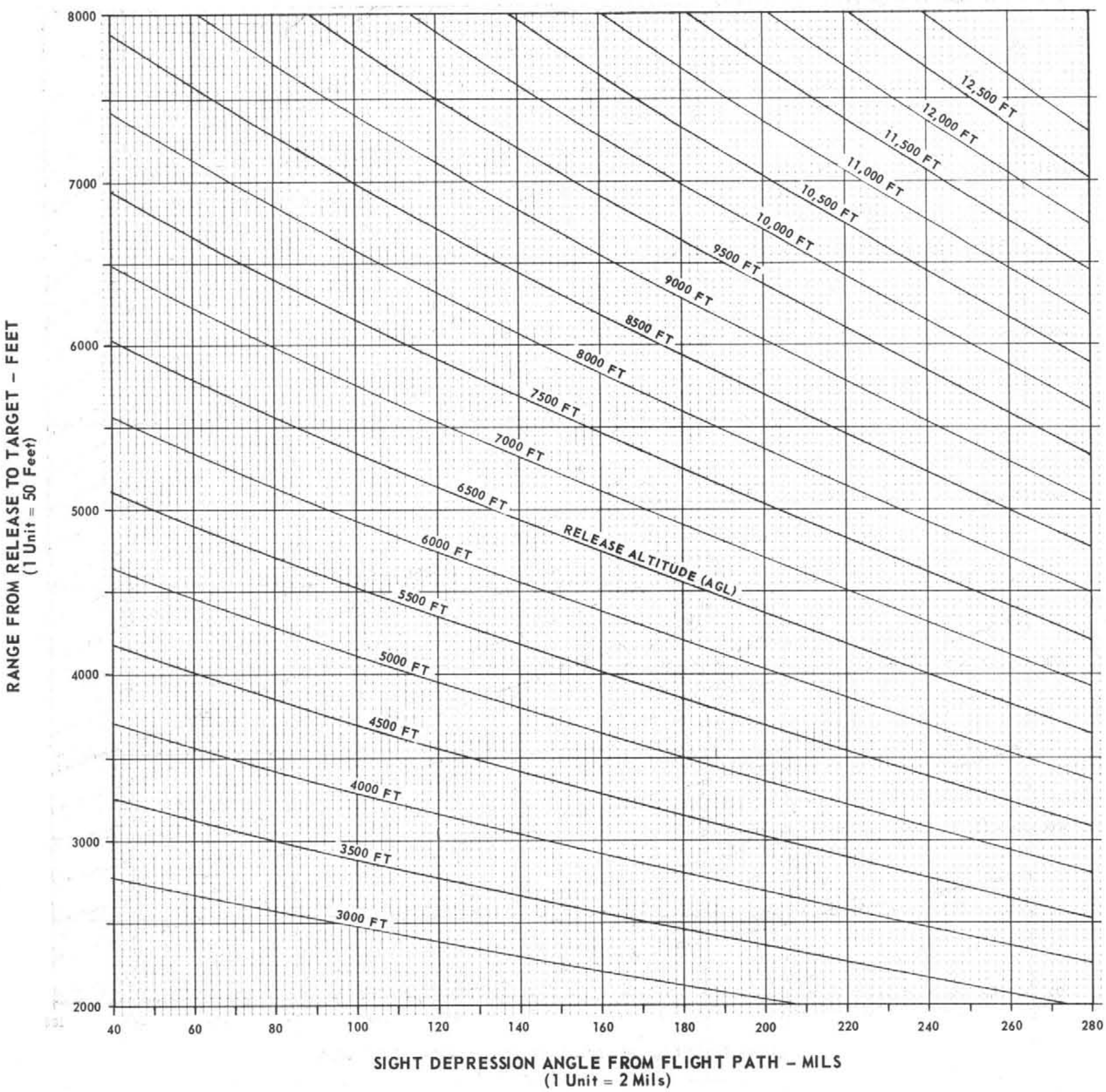


F4-34-VI-108-10

Figure 6-10 (Sheet 10 of 14)

SIGHT DEPRESSION

45° DIVE

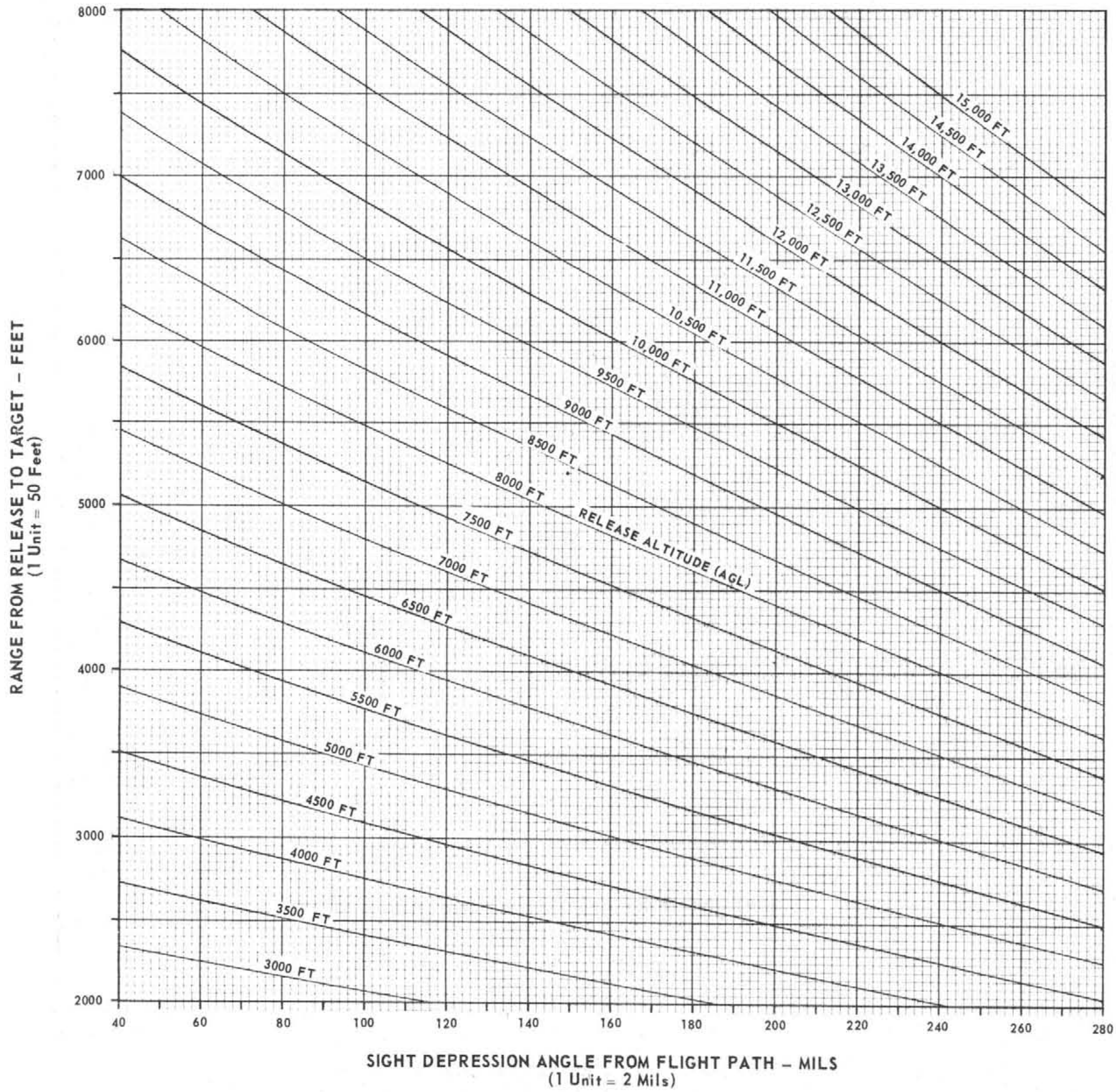


F4-34-VI-108-11

Figure 6-10 (Sheet 11 of 14)

SIGHT DEPRESSION

50° DIVE

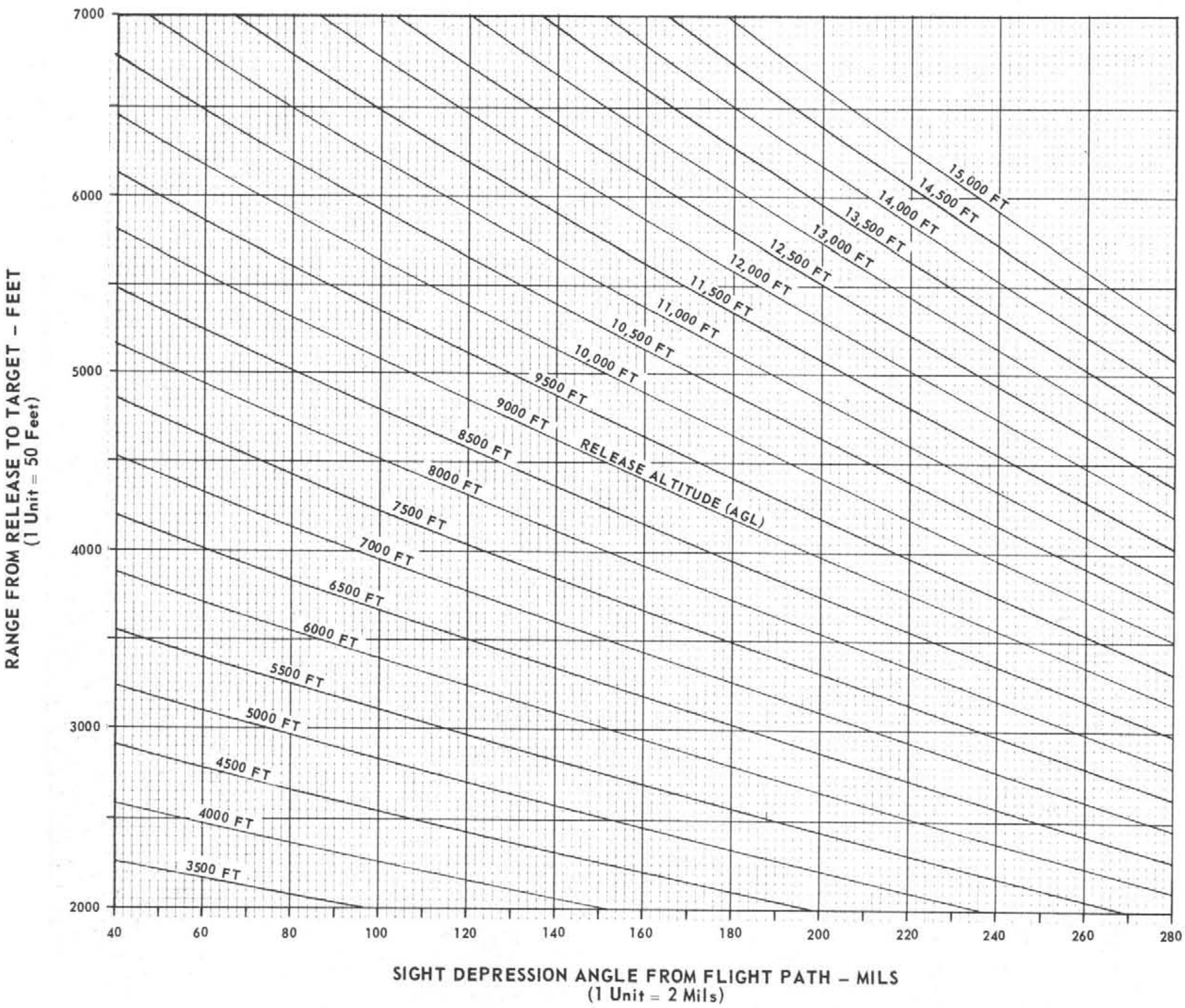


F4-34-VI-108-12

Figure 6-10 (Sheet 12 of 14)

SIGHT DEPRESSION

55° DIVE

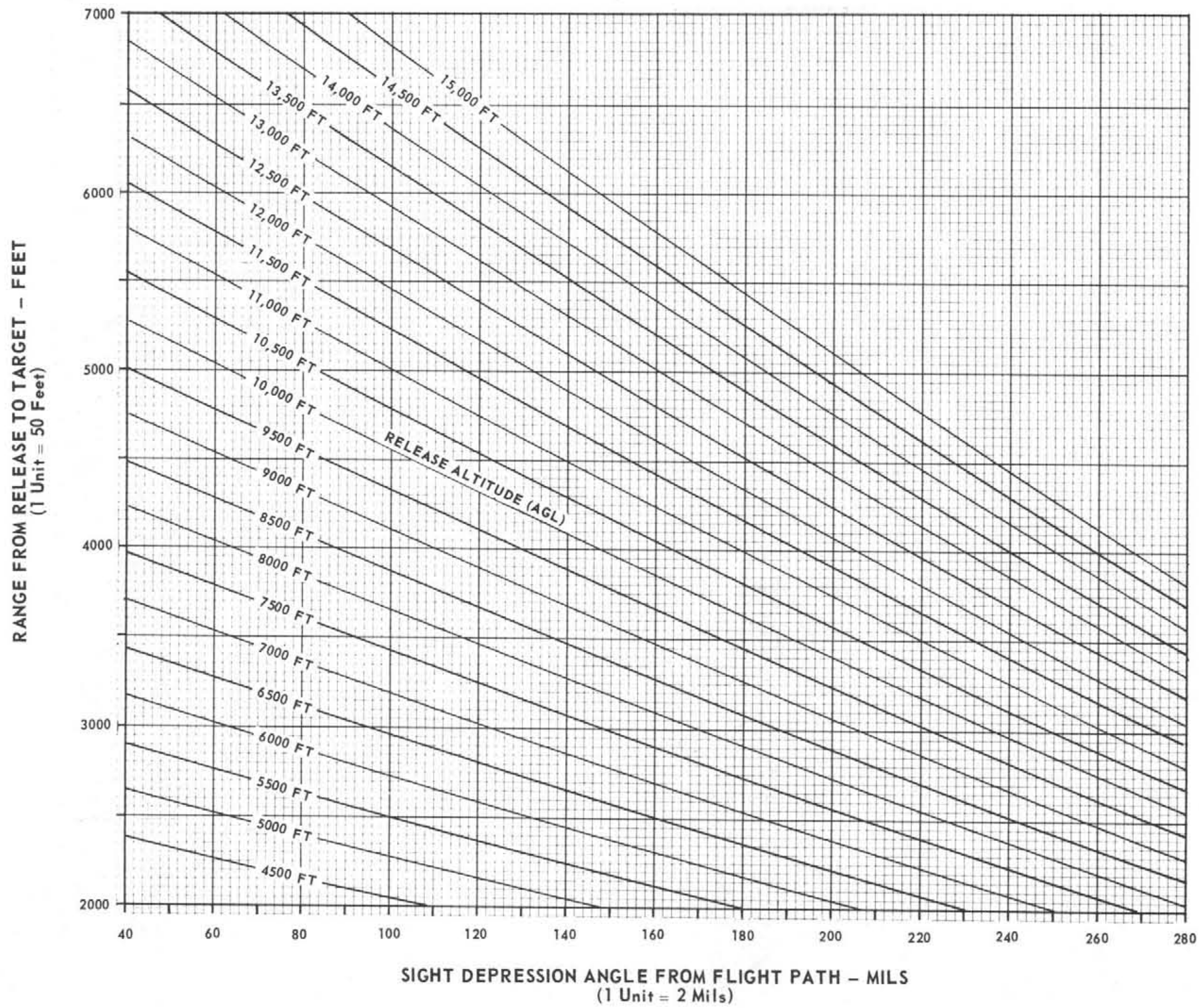


F4-34-VI-108-13

Figure 6-10 (Sheet 13 of 14)

SIGHT DEPRESSION

60° DIVE



F4-34-VI-108-14

Figure 6-10 (Sheet 14 of 14)

RELATIVE WIND VECTOR CHART

EXAMPLE #1:

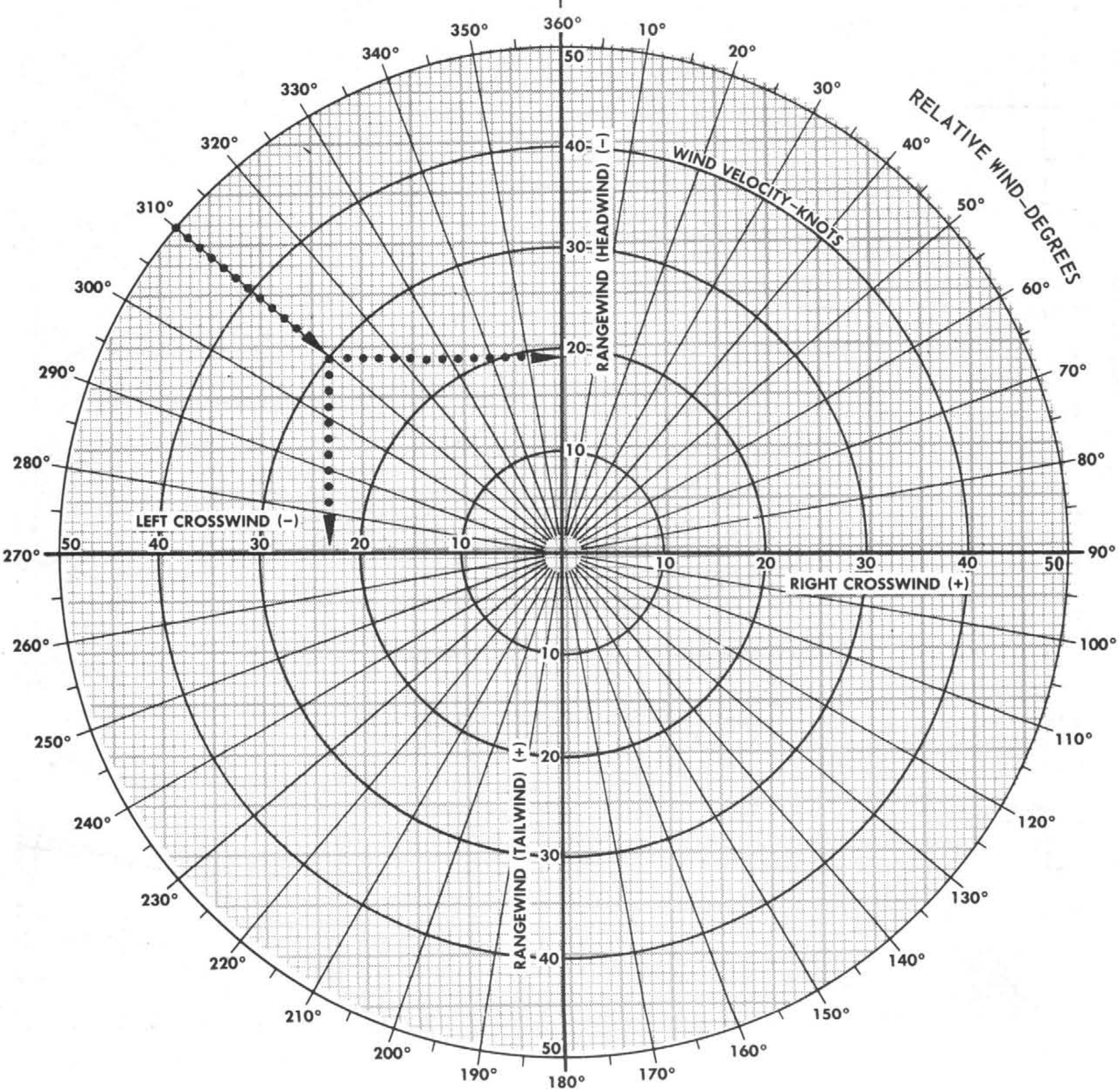
GIVEN:
a. WIND DIRECTION . . . . . 350°
b. APPROACH COURSE . . -040°
FIND: RELATIVE WIND . . . . . 310°

TARGET

EXAMPLE #2:

GIVEN:
a. WIND DIRECTION . . . . . 040°
b. APPROACH COURSE . . 350°
(Since 350° is greater then 040°, add 360° to the wind direction.)

c. WIND DIRECTION . . . . . 400°
b. APPROACH COURSE . . -350°
FIND: RELATIVE WIND . . . . . 050°



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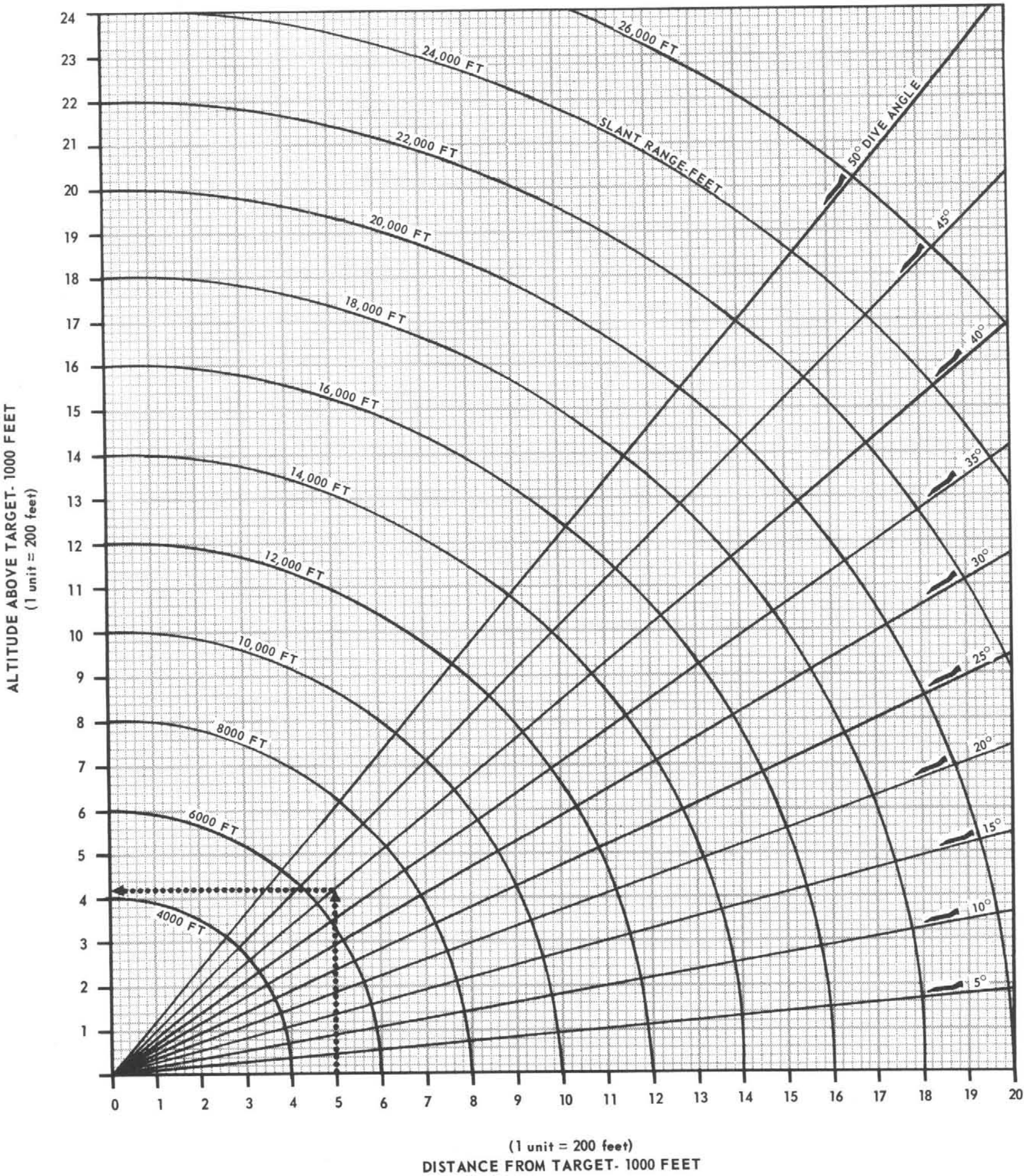
F4-34-VI-109

Figure 6-11

DIVE ANGLE VS DISTANCE



F4-34-VI-110

Figure 6-12

FUZE ARMING

MINIMUM RELEASE ALTITUDE OR VERTICAL DROP REQUIRED FOR GENERAL PURPOSE, LOW DRAG, BOMB FUZE ARMING

RELEASE		M904 M905	M904 M905 FMU-72/B	FMU-26A/B, -26B/B NOSE OR TAIL FUZE ARMING DELAY SETTING	
TAS KTS	DIVE ANGLE DEG	4 SEC FT	6 SEC FT	4 SEC FT	6 SEC FT
360	0	370	830	290	630
360	15	1170	2020	950	1590
360	20	1410	2380	1170	1910
360	25	1640	2720	1370	2210
360	30	1860	3050	1570	2500
360	35	2070	3360	1760	2770
360	40	2270	3650	1940	3030
360	45	2450	3930	2100	3270
360	50	2620	4170	2250	3490
360	55	2730	4350	2390	3690
360	60	2870	4550	2510	3860
400	0	370	830	290	630
400	15	1250	2140	1020	1700
400	20	1520	2540	1260	2050
400	25	1780	2920	1490	2380
400	30	2020	3280	1710	2700
400	35	2250	3630	1920	3010
400	40	2470	3960	2120	3290
400	45	2670	4260	2300	3560
400	50	2860	4530	2470	3800
400	55	2990	4730	2620	4020
400	60	3140	4950	2750	4220
440	0	370	830	290	620
440	15	1340	2260	1100	1810
440	20	1630	2700	1360	2180
440	25	1910	3120	1610	2550
440	30	2180	3520	1850	2900
440	35	2430	3900	2080	3240
440	40	2670	4250	2300	3550
440	45	2900	4590	2500	3850
440	50	3100	4890	2680	4110
440	55	3250	5140	2850	4360
440	60	3410	5360	2990	4570
480	0	370	830	290	620
480	15	1420	2380	1170	1910
480	20	1730	2860	1450	2320
480	25	2040	3310	1730	2720
480	30	2340	3750	1990	3110
480	35	2610	4160	2240	3470
480	40	2880	4550	2480	3810
480	45	3120	4910	2710	4130
480	50	3340	5240	2890	4430
480	55	3510	5490	3070	4690
480	60	3690	5750	3230	4920
520	0	370	820	290	620
520	15	1500	2500	1240	2010
520	20	1840	3010	1550	2460
520	25	2170	3510	1850	2900
520	30	2500	3980	2130	3310
520	35	2790	4430	2400	3700
520	40	3080	4850	2650	4160
520	45	3340	5230	2890	4420
520	50	3580	5590	3110	4730
520	55	3760	5860	3300	5010
520	60	3960	6140	3470	5260

4C-34-1-1-(186-1)

Figure 6-13. (Sheet 1 of 3)

FUZE ARMING (CONTINUED)

MINIMUM RELEASE ALTITUDE OR VERTICAL DROP
REQUIRED FOR
GENERAL PURPOSE, LOW DRAG, BOMB FUZE ARMING

RELEASE		M904 M905	M904 M905 FMU-72/B	FMU-26A/B, -26B/B NOSE OR TAIL FUZE ARMING DELAY SETTING	
TAS KTS	DIVE ANGLE DEG	4 SEC FT	6 SEC FT	4 SEC FT	6 SEC FT
560	0	370	820	290	620
560	15	1580	2610	1310	2110
560	20	1940	3160	1640	2590
560	25	2300	3690	1960	3050
560	30	2640	4190	2260	3500
560	35	2960	4670	2550	3920
560	40	3270	5110	2830	4310
560	45	3550	5520	3080	4680
560	50	3810	5900	3310	5010
560	55	4000	6190	3520	5310
560	60	4210	6490	3700	5580
600	0	370	820	290	620
600	15	1590	2630	1380	2200
600	20	1980	3200	1730	2700
600	25	2360	3760	2060	3190
600	30	2730	4290	2390	3660
600	35	3070	4800	2690	4100
600	40	3390	5270	2980	4510
600	45	3690	5700	3250	4900
600	50	3970	6100	3490	5250
600	55	4210	6460	3710	5560
600	60	4430	6770	3900	5840

4C-34-1-1-(186-2)

Figure 6-13. (Sheet 2 of 3)

FUZE ARMING (CONTINUED)

CBU-24B/B OR CBU-58/B
MINIMUM RELEASE ALTITUDE FOR FUZE ARMING

HOB - 1800 FEET
ARMING TIME - 3.0 SECONDS

RELEASE DIVE ANGLE	MINIMUM RELEASE ALTITUDES					
DEG	400 KTAS	440 KTAS	480 KTAS	520 KTAS	560 KTAS	600 KTAS
0	2020	2020	2020	2020	2020	2020
15	2630	2690	2750	2800	2850	2910
30	3190	3300	3420	3530	3650	3750
45	3670	3830	3990	4150	4310	4450

Note

These minimum release altitudes for a 3-second arming time are based on an 1800 ft Height-of-Burst (HOB). To determine the minimum release altitudes for other HOB's, algebraically add the difference between the planned HOB and 1800 ft to the values listed in the table.

4C-34-1-1-(186-3)

Figure 6-13. (Sheet 3 of 3)

SAFE ESCAPE

DIVE DELIVERY-LOW DRAG

MINIMUM RELEASE ALTITUDE*
REQUIRED FOR SAFE SEPARATION AND GROUND CLEARANCE DURING RECOVERY

RELEASE		ALTITUDE LOST DURING PULLOUT	MINIMUM REL ALT FOR FRAGMENTATION ENVELOPE CLEARANCE (FEET)					
TAS KTS	DIVE ANGLE DEG		M118 BOMB	M117 BOMB	MK 84 BOMB	MK 83 BOMB	MK 82 BOMB	BLU–31/B LAND MINE
360	10	150	1100	1000	1200	1000	900	1000
360	15	280	1300	1200	1400	1200	1000	1200
360	20	430	1500	1500	1700	1500	1300	1400
360	25	610	1800	1700	1900	1700	1500	1600
360	30	820	2000	1900	2200	1900	1700	1900
360	35	1050	2200	2100	2400	2100	1900	2000
360	40	1300	2400	2300	2600	2300	2100	2200
360	45	1580	2600	2500	2800	2500	2200	2400
360	50	1880	2700	2600	2900	2600	2400	2500
360	55	2200	2900	2800	3100	2800	2500	2700
360	60	2550	3000	2900	3200	2900	2600	2800
400	10	170	1100	1000	1200	1000	900	900
400	15	330	1300	1200	1400	1200	1100	1200
400	20	510	1600	1500	1700	1500	1300	1400
400	25	730	1800	1700	2000	1700	1500	1700
400	30	980	2100	1900	2200	2000	1800	1900
400	35	1270	2300	2200	2500	2200	1900	2100
400	40	1580	2500	2400	2700	2400	2200	2300
400	45	1930	2700	2600	2900	2600	2300	2400
400	50	2310	2900	2700	3100	2800	2500	2500
400	55	2720	3100	2900	3300	2900	2800	2800
400	60	3150	3200	3200	3400	3200	3200	3200
440	10	200	1100	1000	1200	1000	900	900
440	15	380	1400	1200	1500	1300	1100	1200
440	20	600	1600	1500	1800	1500	1400	1400
440	25	860	1900	1800	2100	1800	1500	1600
440	30	1160	2200	2000	2300	2100	1900	1800
440	35	1500	2400	2300	2600	2300	1900	2000
440	40	1880	2600	2400	2800	2500	2300	2200
440	45	2300	2900	2700	3100	2800	2300	2400
440	50	2760	3100	2800	3300	2900	2800	2800
440	55	3250	3300	3300	3400	3300	3300	3300
440	60	3770	3800	3800	3800	3800	3800	3800
480	10	230	1100	1000	1200	1000	900	900
480	15	430	1400	1200	1500	1300	1200	1100
480	20	690	1700	1500	1800	1600	1400	1400
480	25	990	2000	1800	2100	1900	1500	1600
480	30	1340	2300	2000	2400	2100	1900	1900
480	35	1750	2500	2300	2700	2400	2000	2100
480	40	2200	2800	2400	3000	2600	2400	2300
480	45	2700	3000	2700	3200	2900	2700	2700
480	50	3240	3300	3300	3400	3300	3300	3300
480	55	3820	3900	3900	3900	3900	3900	3900
480	60	4440	4500	4500	4500	4500	4500	4500
520	10	260	1100	900	1200	1000	900	900
520	15	490	1400	1200	1500	1300	1200	1200
520	20	780	1800	1500	1900	1600	1500	1400
520	25	1130	2100	1800	2200	2000	1600	1700
520	30	1540	2400	2000	2500	2200	2000	2000
520	35	2010	2700	2300	2800	2500	2100	2200
520	40	2530	2900	2600	3100	2700	2600	2600
520	45	3110	3200	3200	3300	3200	3200	3200
520	50	3740	3800	3800	3800	3800	3800	3800
520	55	4420	4500	4500	4500	4500	4500	4500
520	60	5140	5200	5200	5200	5200	5200	5200
560	10	290	1100	900	1200	1000	900	900
560	15	550	1500	1200	1600	1300	1200	1200
560	20	880	1800	1500	1900	1700	1500	1500
560	25	1280	2100	1800	2300	2000	1700	1700
560	30	1750	2400	2000	2600	2200	2100	2000
560	35	2280	2700	2300	2900	2600	2300	2300
560	40	2880	3000	2900	3200	2900	2900	2900
560	45	3540	3600	3600	3600	3600	3600	3600
560	50	4250	4300	4300	4300	4300	4300	4300
560	55	5010	5100	5100	5100	5100	5100	5100
560	60	5810	5900	5900	5900	5900	5900	5900
600	10	320	1100	900	1200	1000	900	900
600	15	620	1500	1200	1600	1300	1200	1200
600	20	990	1800	1500	2000	1700	1600	1500
600	25	1440	2100	1900	2400	2000	1700	1700
600	30	1960	2500	2100	2700	2300	2200	2000
600	35	2560	2800	2600	3100	2600	2600	2600
600	40	3230	3300	3300	3400	3300	3300	3300
600	45	3960	4000	4000	4000	4000	4000	4000
600	50	4730	4800	4800	4800	4800	4800	4800
600	55	5560	5600	5600	5600	5600	5600	5600
600	60	6410	6500	6500	6500	6500	6500	6500

* THESE MINIMUM RELEASE ALTITUDES ARE BASED ON A 4.0G RECOVERY AND ASSUME THAT THE 4.0G IS ATTAINED WITHIN 2.0 SEC AFTER RELEASE.

Note THE AIRCREW MUST DETERMINE THE MINIMUM RELEASE ALTITUDE THAT WILL PROVIDE THE REQUIRED GROUND CLEARANCE.

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Figure 6-14 (Sheet 1 of 2)

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SAFE ESCAPE (continued)

LEVEL DELIVERY-LOW DRAG

MINIMUM RELEASE ALTITUDES
FOR SAFE SEPARATION (LEVEL RELEASE)

RELEASE TAS KNOTS	MINIMUM REL ALT FOR FRAGMENTATION ENVELOPE CLEARANCE (FEET)					
	M118 BOMB	MK 84 BOMB	MK 83 BOMB	M 117 BOMB	MK 82 BOMB	BLU-31/B LAND MINE
4.0 G MIL POWER PULLUP *						
360	500	600	500	500	400	500
400	500	600	400	400	400	400
440	500	500	400	400	300	300
480	400	500	400	400	300	300
520	400	500	400	400	300	300
560	400	500	300	400	300	300
600	400	500	300	400	400	300
STRAIGHT AND LEVEL CONSTANT SPEED						
360	1400	1700	1300	1200	1100	900
400	1300	1600	1200	1100	1000	800
440	1200	1500	1100	1100	900	700
480	1100	1400	1000	1000	800	500
520	1000	1400	900	900	900	400
560	1000	1300	800	900	900	400
600	900	1200	600	800	700	400

* THESE MINIMUM RELEASE ALTITUDES ASSUME THAT A 4.0G MIL POWER IS ATTAINED 2.0 SECONDS AFTER RELEASE. THE G IS MAINTAINED UNTIL A 20 DEG – 30 DEG CLIMB OUT ANGLE IS ATTAINED. AN ALTERNATE MANEUVER MAY BE ACCOMPLISHED BY PERFORMING A 4.0-G BANKED TURN USING A 60° BANK ANGLE. THIS COMBINATION OF G FORCES AND BANK ANGLE WILL PRODUCE A CLIMBING TURN---NOT A LEVEL TURN.

2.75 INCH FFAR

MINIMUM LAUNCH ALTITUDES
REQUIRED FOR SAFE RECOVERY FROM FRAGMENTS

2.75 FFAR W/MK 1 WARHEAD
4.0 G RECOVERY TO 10 DEG CLIMB

RELEASE KTAS	RELEASE DIVE ANGLE – DEGREE						
	10	15	20	25	30	45	60
360	600	900	1100	1300	1500	2100	2400
380	600	900	1100	1400	1600	2300	2700
400	700	900	1100	1400	1600	2300	3000
420	700	900	1200	1500	1700	2300	3300
440	700	1000	1300	1500	1800	2400	3700
460	700	1000	1400	1600	1900	2500	4000
480	700	1100	1400	1700	2000	2700	4400
500	800	1100	1400	1700	2000	2900	4700
520	800	1100	1400	1800	2200	3200	5100
540	900	1200	1500	1900	2400	3400	5500
560	900	1200	1500	1900	2400	3600	5800

2.75 FFAR W/M 151 WARHEAD
4.0 G RECOVER TO 10 DEG CLIMB

RELEASE KTAS	RELEASE DIVE ANGLE – DEGREE						
	10	15	20	25	30	45	60
360	500	700	900	1100	1300	1900	2400
380	500	800	1000	1200	1400	2000	2700
400	600	800	1000	1300	1500	2000	3000
420	600	800	1100	1300	1500	2200	3300
440	600	900	1100	1400	1600	2300	3700
460	700	900	1200	1400	1700	2500	4000
480	700	1000	1200	1500	1700	2700	4400
500	700	1000	1300	1500	1800	2900	4700
520	700	1000	1300	1600	1900	3200	5100
540	800	1100	1400	1600	2000	3500	5500
560	800	1100	1400	1700	2100	3700	5800

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Figure 6-14 (Sheet 2 of 2)

FUZE ARMING and SAFE ESCAPE

HIGH DRAG RETARDED GP BOMBS

RELEASE: TAS (KNOTS)	RELEASE: DIVE ANGLE (DEG)	ALT LOST DURING PULL OUT FEET	SAFE ESCAPE* MIN REL ALT FOR FRAG ENVELOPE CLEARANCE (FT): MK82 (SNAKEYE 1) GP BOMB	SAFE ESCAPE* MIN REL ALT FOR FRAG ENVELOPE CLEARANCE (FT): M117 (RETARDED) GP BOMB	FUZE ARMING ** MIN REL ALT FOR M904E2 FUZE WITH 2-SEC DELAY (FT): MK82 (SNAKEYE) GP BOMB	FUZE ARMING ** MIN REL ALT FOR M904E2 FUZE WITH 2-SEC DELAY (FT): M117 (RETARDED) GP BOMB	FUZE ARMING ** MIN REL ALT FOR FMU-54/B WITH 2.5 SEC DELAY (FT): MK82 (SNAKEYE 1) GP BOMB	FUZE ARMING ** MIN REL ALT FOR FMU-54/B WITH 2.5 SEC DELAY (FT): M117 (RETARDED) GP BOMB
360	0	---	150	125	105	90	125	115
	10	150	400	400	315	295	350	325
	20	430	600	600	**	**	**	**
	30	820	1000	900	**	**	**	**
400	0	---	120	100	100	85	120	110
	10	170	400	400	330	305	365	340
	20	510	700	600	**	**	**	**
	30	980	1100	1000	**	**	**	**
440	0	---	115	75	100	85	120	110
	10	200	400	300	345	320	385	355
	20	600	700	600	**	**	**	**
	30	1160	1300	1200	**	**	**	**
480	0	---	100	50	95	85	115	110
	10	230	400	300	360	330	400	370
	20	690	800	700	**	**	**	**
	30	1340	1500	1400	**	**	**	**
520	0	---	80	50	95	80	115	105
	10	260	400	300	375	345	415	385
	20	780	900	800	**	**	**	**
	30	1540	1700	1600	**	**	**	**
560	0	---	55	50	95	80	115	105
	10	290	400	300	390	355	430	395
	20	880	1000	900	**	**	**	**
	30	1750	1900	1800	**	**	**	**
600	0	---	50	50	95	80	115	105
	10	320	400	400	405	365	445	410
	20	990	1100	1000	**	**	**	**
	30	1960	2000	2000	**	**	**	**

* These minimum release altitudes are based on 4.0G recovery and assume that the 4.0G is attained within 2.0 Sec., after release. The aircrew must determine the minimum release altitude that will provide the required ground clearance.

** For the 20° and 30° dive release conditions listed, the bomb time of flight is more than adequate to assure fuze arming for the M904 fuze with a 2.0 Sec., arming delay setting and the FMU-54/B fuze with a 2.5 Sec., arming delay setting.

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Figure 6-15

FUZE SAFE ARMING TIME REQUIRED

LOW ALTITUDE LEVEL RELEASE – LEVEL, CONSTANT SPEED ESCAPE MANEUVER

REL KTAS	SAFE ARMING TIME SEC	VERTICAL DROP TO FUZE ARMING FEET	AIRCRAFT TO BOMB SLANT RANGE DISTANCE AT FUZE ARMING FEET
M117, MK-81, MK-82			
400	7.8	1000	1000
500	6.9	800	810
600	6.0	600	630
MK-83			
400	8.5	1200	1200
500	7.4	900	910
600	6.0	600	610
MK-84			
400	9.6	1600	1600
500	8.9	1400	1410
600	8.3	1200	1210
M118			
400	8.7	1300	1300
500	8.0	1100	1110
600	7.2	900	910

Note

The values listed are applicable for use with single, pairs, salvo, or timed ripple releases. A straight and level, constant-speed, escape maneuver is assumed after release.

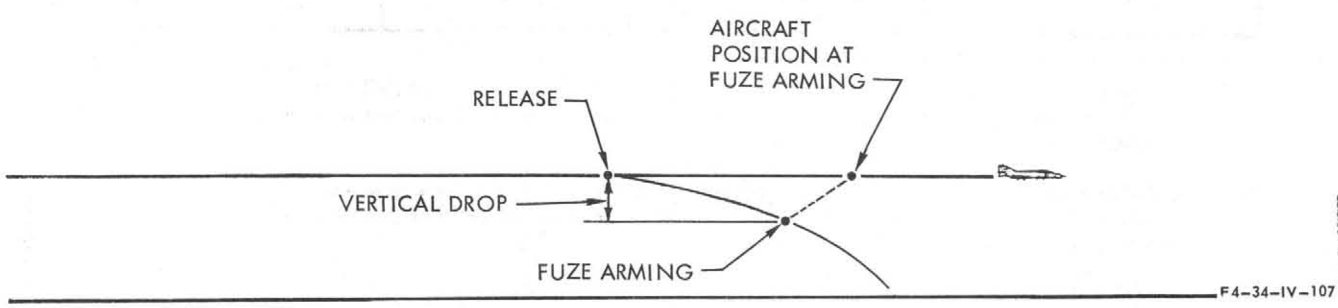

Figure 6-16 (Sheet 1 of 7)

FUZE SAFE ARMING TIME REQUIRED

LOW ALTITUDE LEVEL RELEASE – 4.0 G PULLUP
OR 4.0 G – 60° BANKED TURN ESCAPE MANEUVER.

REL KTAS	SAFE ARMING TIME SEC	VERTICAL DROP TO FUZE ARMING FEET	AIRCRAFT TO BOMB SLANT RANGE DISTANCE AT FUZE ARMING FEET
		M117, MK-81, MK-82	
400	4.8	400	1080
500	4.2	300	800
600	4.2	300	800
		MK-83	
400	4.9	400	1090
500	4.4	350	900
600	4.2	300	800
		MK-84	
400	5.7	600	1540
500	5.2	500	1320
600	5.2	500	1330
		M118	
400	5.3	500	1300
500	4.7	400	1050
600	4.7	400	1050

Note

The values listed are applicable for use with singles, pairs, or salvo type releases only and assume that the aircraft attains the 4.0 G escape maneuver acceleration within two seconds after release. If a low altitude level ripple release is to be accomplished where the aircraft is held straight and level throughout the entire ripple release time cycle, the safe arming times listed for a level release - level constant speed escape maneuver should be used and minimum release altitudes selected accordingly.

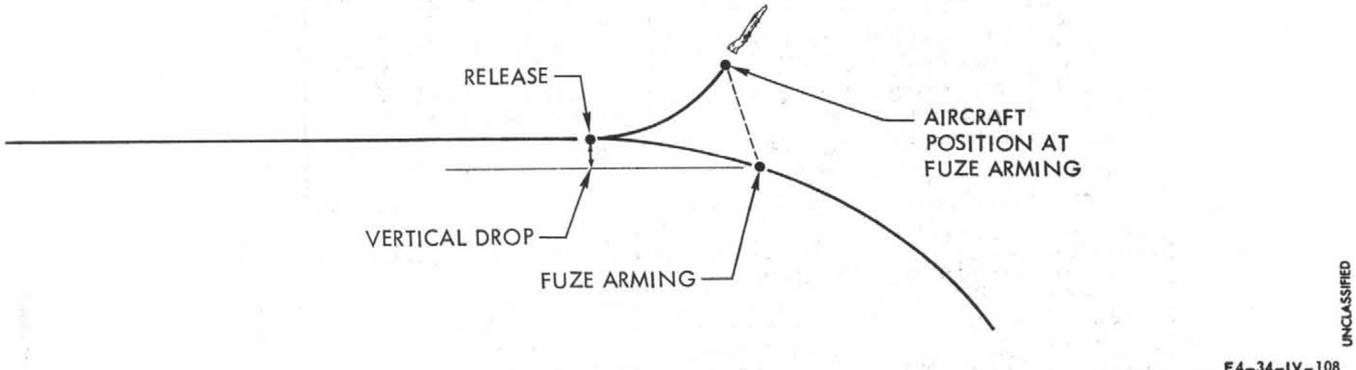

Figure 6-16 (Sheet 2 of 7)

FUZE SAFE ARMING TIME REQUIRED

LOW TO MEDIUM ALTITUDE DIVE RELEASE – 4.0 G
PULLUP TO 20° – 30° CLIMB ESCAPE MANEUVER

RELEASE TAS KTS	RELEASE DIVE ANGLE DEG	SAFE ARMING TIME SEC	VERTICAL DROP TO FUZE ARMING FEET	AIRCRAFT TO BOMB SLANT RANGE DISTANCE AT FUZE ARMING FEET
M117, MK-81, MK-82				
400	15	4.7	1200	1050
	30	4.7	1900	1030
	45	4.7	2600	990
500	15	4.2	1200	790
	30	4.2	2000	760
	45	4.2	2800	740
600	15	3.8	1200	620
	30	3.8	2100	610
	45	3.8	2950	630
MK-83				
400	15	4.8	1250	1100
	30	4.8	2000	1080
	45	4.7	2600	990
500	15	4.5	1300	920
	30	4.5	2200	910
	45	4.5	3000	890
600	15	4.1	1400	810
	30	4.1	2300	730
	45	4.1	3200	750
MK-84				
400	15	5.2	1400	1340
	30	5.1	2200	1280
	45	5.1	2900	1260
500	15	4.9	1500	1170
	30	4.9	2500	1160
	45	4.7	3200	1060
600	15	4.6	1600	1030
	30	4.6	2700	1010
	45	4.6	3700	1040
M118				
400	15	5.0	1300	1190
	30	5.0	2100	1180
	45	4.9	2700	1100
500	15	4.7	1400	1040
	30	4.7	2300	1030
	45	4.7	3100	1020
600	15	4.5	1500	930
	30	4.4	2500	870
	45	4.4	3500	890

Note

The values listed are applicable for use with singles, pairs or salvo type releases only and assume that the aircraft attains the 4.0 G escape maneuver acceleration within two seconds after release. For timed ripple releases, where the aircraft remains in a fixed dive angle flight condition until the last bomb is released, the safe arming time should be increased by an amount equal to the ripple release time cycle.

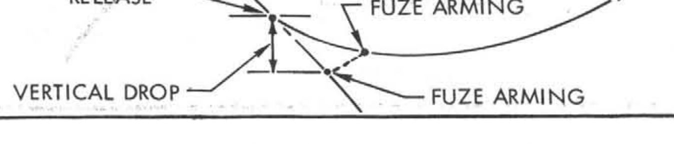

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Figure 6-16 (Sheet 3 of 7)

FUZE SAFE ARMING TIME REQUIRED

HIGH ALTITUDE LEVEL RELEASE – LEVEL, CONSTANT SPEED ESCAPE MANEUVER

RELEASE ALTITUDE ABOVE TARGET FEET	RELEASE TAS KTS	SAFE ARMING TIME SEC	VERTICAL DROP TO FUZE ARMING FEET	AIRCRAFT TO BOMB SLANT RANGE DISTANCE AT FUZE ARMING FEET
M117, MK-81, MK-82				
10,000 OR LOWER	400	8	1060	1070
	500	7	820	830
	600	6	600	630
20,000	400	11	1980	1990
	500	9	1340	1350
	600	8	1050	1090
30,000	400	13	2780	2780
	500	11	1980	1990
	600	10	1640	1680
MK-83				
10,000 OR LOWER	400	9	1340	1340
	500	8	1060	1060
	600	7	830	850
20,000	400	12	2360	2360
	500	11	1980	1980
	600	10	1630	1650
30,000	400	14	3190	3190
	500	13	2760	2760
	600	12	2330	2350
MK-84				
10,000 OR LOWER	400	10	1740	1740
	500	9	1430	1430
	600	9	1420	1430
20,000	400	13	2890	2890
	500	12	2470	2470
	600	11	2080	2090
30,000	400	15	3810	3810
	500	14	3330	3330
	600	13	2860	2870
M118				
10,000 OR LOWER	400	9	1400	1400
	500	8	1100	1110
	600	8	1110	1120
20,000	400	12	2440	2440
	500	11	2060	2060
	600	10	1690	1720
30,000	400	14	3290	3290
	500	13	2840	2850
	600	12	2390	2430

Note

The lower air density at high altitudes is responsible for the increase in required safe arming time for high altitude releases. A linear interpolation between the safe arming time values listed for 10,000, 20,000, and 30,000 feet may be accomplished to determine the required safe arming time value for intermediate altitudes.

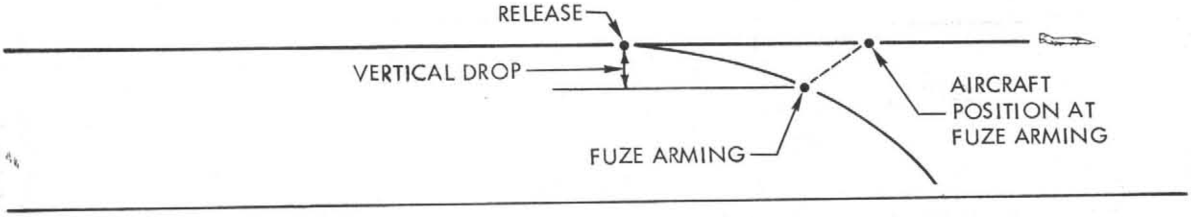

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Figure 6-16 (Sheet 4 of 7)

FUZE SAFE ARMING TIME REQUIRED

HIGH ALTITUDE LEVEL RELEASE
2.0 G PULLUP – MILITARY POWER

RELEASE ALTITUDE ABOVE TARGET FEET	RELEASE TAS KTS	SAFE ARMING TIME SEC	VERTICAL DROP TO FUZE ARMING FEET	AIRCRAFT TO BOMB SLANT RANGE DISTANCE AT FUZE ARMING FEET
M117, MK–81, MK–82				
10,000 OR LOWER	400	6	609	1020
	500	6	608	1022
	600	6	603	1020
20,000	400	8	1066	1845
	500	7	821	1403
	600	7	811	1394
30,000	400	11	1990	3059
	500	9	1341	2357
	600	8	1048	1824
MK–83				
10,000 OR LOWER	400	7	818	1403
	500	6	605	1016
	600	6	602	1011
20,000	400	9	1338	2350
	500	7	817	1399
	600	7	812	1390
30,000	400	11	1986	3061
	500	10	1645	2930
	600	9	1326	2344
MK–84				
10,000 OR LOWER	400	7	888	1473
	500	7	887	1474
	600	7	885	1467
20,000	400	10	1746	3012
	500	9	1427	2452
	600	9	1422	2444
30,000	400	13	2891	4346
	500	11	2095	3674
	600	10	1733	3021
M118				
10,000 OR LOWER	400	7	866	1451
	500	7	865	1453
	600	7	860	1444
20,000	400	9	1400	2412
	500	8	1116	1904
	600	8	1105	1888
30,000	400	11	2062	3136
	500	11	2059	3636
	600	10	1688	2965

Notes

- The values listed are applicable for use with singles, pairs, or salvo type releases only and assume that the aircraft attains the pre-planned escape maneuver pullup acceleration within two seconds after release. For timed ripple releases, where the aircraft remains in a straight and level flight path condition until the last bomb is released, the safe arming time should be increased by an amount equal to the ripple release time cycle.
- The lower air density at high altitudes is responsible for the increase in required safe arming time for high altitude releases. A linear interpolation between the safe arming time values listed for 10,000, 20,000, and 30,000 feet may be accomplished to determine the required safe arming time value for intermediate altitudes.

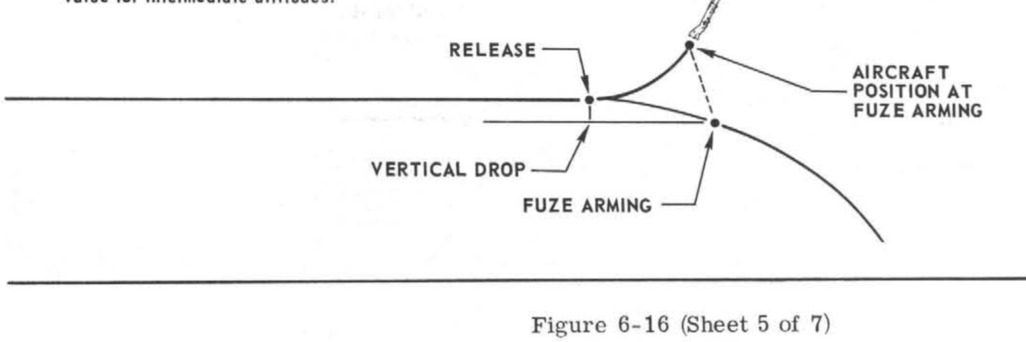

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Figure 6-16 (Sheet 5 of 7)

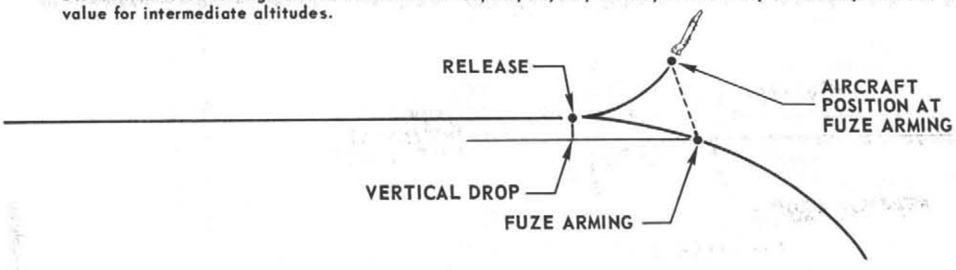
FUZE SAFE ARMING TIME REQUIRED

HIGH ALTITUDE LEVEL RELEASE
3.0 G PULLUP – MILITARY POWER

RELEASE		SAFE ARMING TIME SEC	VERTICAL DROP TO FUZE ARMING FEET	AIRCRAFT TO BOMB SLANT RANGE DISTANCE AT FUZE ARMING FEET
ALTITUDE ABOVE TARGET FEET	TAS KTS			
M117, MK–81, MK–82				
10,000 OR LOWER	400	6	609	1389
	500	5	528	949
	600	5	425	947
20,000	400	8	1066	2237
	500	6	609	1407
	600	6	603	1400
30,000	400	11	1990	3296
	500	9	1341	2731
	600	7	810	1899
MK–83				
10,000 OR LOWER	400	6	605	1387
	500	6	605	1409
	600	5	423	943
20,000	400	8	1062	2239
	500	7	817	1946
	600	6	602	1404
30,000	400	11	1986	3301
	500	9	1337	2734
	600	8	1054	2529
MK–84				
10,000 OR LOWER	400	7	888	1962
	500	6	665	1469
	600	6	664	1469
20,000	400	9	1429	2895
	500	8	1142	2627
	600	7	885	2035
30,000	400	12	2479	3989
	500	10	1746	3476
	600	9	1419	3301
M118				
10,000 OR LOWER	400	7	866	1939
	500	6	646	1450
	600	6	643	1446
20,000	400	8	1118	2293
	500	7	866	1994
	600	7	858	2000
30,000	400	11	2062	3375
	500	10	1714	3442
	600	9	1381	3243

Notes

- The values listed are applicable for use with singles, pairs, or salvo type releases only and assume that the aircraft attains the pre-planned escape maneuver pullup acceleration within two seconds after release. For timed ripple releases, where the aircraft remains in a straight and level flight path condition until the last bomb is released, the safe arming time should be increased by an amount equal to the ripple release time cycle.
- The lower air density at high altitudes is responsible for the increase in required safe arming time for high altitude releases. A linear interpolation between the safe arming time values listed for 10,000, 20,000, and 30,000 feet may be accomplished to determine the required safe arming time value for intermediate altitudes.



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F4-34-IV-110-3

Figure 6-16 (Sheet 6 of 7)

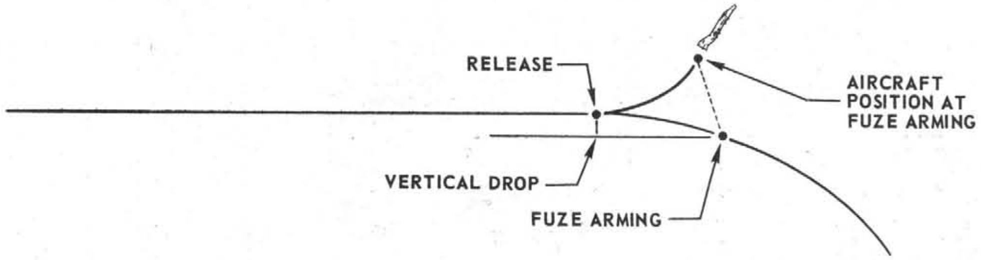
FUZE SAFE ARMING TIME REQUIRED

HIGH ALTITUDE LEVEL RELEASE
4.0 G PULLUP – MILITARY POWER

RELEASE ALTITUDE ABOVE TARGET FEET	RELEASE TAS KTS	SAFE ARMING TIME SEC	VERTICAL DROP TO FUZE ARMING FEET	AIRCRAFT TO BOMB SLANT RANGE DISTANCE AT FUZE ARMING FEET
M117, MK–81, MK–82				
10,000 OR LOWER	400	6	609	1583
	500	5	428	1189
	600	5	425	1196
20,000	400	8	1066	2440
	500	6	609	1609
	600	5	424	1191
30,000	400	11	1990	3545
	500	9	1341	2979
	600	7	810	2078
MK–83				
10,000 OR LOWER	400	6	605	1584
	500	5	425	1188
	600	5	423	1197
20,000	400	8	602	2444
	500	7	817	2190
	600	6	602	1773
30,000	400	11	1986	3551
	500	9	1337	2985
	600	8	1054	2753
MK–84				
10,000 OR LOWER	400	7	888	2177
	500	6	665	1795
	600	6	664	1842
20,000	400	9	1429	3110
	500	7	888	2260
	600	7	885	2299
30,000	400	12	2479	4292
	500	10	1746	3757
	600	9	1419	3559
M118				
10,000 OR LOWER	400	6	647	1625
	500	5	459	1223
	600	5	457	1231
20,000	400	8	1118	2497
	500	7	866	2237
	600	6	642	1809
30,000	400	11	2062	3625
	500	9	2400	3045
	600	8	1104	2791

Notes

- The values listed are applicable for use with singles, pairs, or salvo type releases only and assume that the aircraft attains the pre-planned escape maneuver pullup acceleration within two seconds after release. For timed ripple releases, where the aircraft remains in a straight and level flight path condition until the last bomb is released, the safe arming time should be increased by an amount equal to the ripple release time cycle.
- The lower air density at high altitudes is responsible for the increase in required safe arming time for high altitude releases. A linear interpolation between the safe arming time values listed for 10,000, 20,000, and 30,000 feet may be accomplished to determine the required safe arming time value for intermediate altitudes.



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F4-34-IV-110-4

Figure 6-16 (Sheet 7 of 7)

WRCS DRAG COEFFICIENTS F-4D F-4E

FOR ALL BOMBS $V_e = 0$ fps (0 volts)

BOMB	DIVE ANGLE DEG	RELEASE TAS KTS	5000 AND BELOW	PICKLE SLANT RANGE (FEET) 7500	10,000	15,000	20,000
M 117 GP	15	400	1.00	1.02	1.03	1.05	1.07
		500	1.01	1.02	1.03	1.05	1.08
		600	1.02	1.04	1.06	1.10	1.15
	30	400	1.00	1.01	1.02	1.04	1.06
		500	1.00	1.01	1.02	1.05	1.08
		600	1.02	1.04	1.07	1.12	1.17
	45	400	1.00	1.01	1.02	1.04	1.06
		500	1.00	1.01	1.02	1.05	1.09
		600	1.02	1.05	1.08	1.14	1.22
	60	400	1.00	1.02	1.03	1.05	1.07
		500	1.01	1.02	1.03	1.07	1.10
		600	1.01	1.05	1.09	1.16	1.23
M 117/MAU-91 (LOW DRAG)	15	400	1.19	1.17	1.17	1.18	1.21
		500	1.23	1.20	1.19	1.20	1.23
		600	1.27	1.24	1.20	1.26	1.31
	30	400	1.23	1.20	1.19	1.21	1.23
		500	1.26	1.22	1.21	1.22	1.26
		600	1.31	1.27	1.27	1.30	1.36
	45	400	1.29	1.24	1.23	1.23	1.25
		500	1.32	1.27	1.25	1.26	1.29
		600	1.40	1.33	1.33	1.37	1.43
	60	400	1.45	1.38	1.35	1.34	1.34
		500	1.49	1.40	1.36	1.36	1.36
		600	1.54	1.45	1.43	1.47	1.50
MK 82 LDGP	15	400	1.00	1.02	1.03	1.05	1.07
		500	1.02	1.03	1.03	1.05	1.07
		600	1.03	1.04	1.06	1.09	1.13
	30	400	1.01	1.02	1.03	1.05	1.06
		500	1.01	1.02	1.03	1.05	1.08
		600	1.03	1.04	1.06	1.10	1.14
	45	400	1.01	1.02	1.03	1.04	1.06
		500	1.01	1.02	1.03	1.06	1.09
		600	1.03	1.05	1.07	1.11	1.16
	60	400	1.03	1.04	1.05	1.06	1.08
		500	1.04	1.04	1.05	1.08	1.11
		600	1.03	1.05	1.08	1.13	1.19
MK 82 SNAKEYE I (LOW DRAG)	15	400	1.03	1.05	1.07	1.10	1.14
		500	1.03	1.05	1.07	1.11	1.15
		600	1.05	1.08	1.11	1.17	1.23
	30	400	1.03	1.05	1.06	1.10	1.14
		500	1.03	1.04	1.06	1.10	1.14
		600	1.05	1.08	1.11	1.18	1.22
	45	400	1.03	1.04	1.06	1.09	1.12
		500	1.03	1.04	1.06	1.11	1.14
		600	1.06	1.09	1.12	1.20	1.18
	60	400	1.05	1.06	1.08	1.11	1.14
		500	1.05	1.07	1.08	1.13	1.18
		600	1.06	1.10	1.14	1.22	1.30
MK 83 LDGP	15	400	1.00	1.00	1.00	1.02	1.03
		500	1.00	1.00	1.01	1.02	1.04
		600	1.00	1.00	1.01	1.03	1.05
	30	400	1.00	1.00	1.00	1.01	1.03
		500	1.00	1.00	1.00	1.01	1.04
		600	1.00	1.00	1.00	1.03	1.05
	45	400	1.00	1.00	1.00	1.01	1.02
		500	1.00	1.00	1.00	1.01	1.03
		600	1.00	1.00	1.00	1.04	1.07
	60	400	1.00	1.00	1.00	1.02	1.02
		500	1.00	1.02	1.00	1.02	1.03
		600	1.00	1.00	1.00	1.04	1.07
MK 84 LDGP	15	400	1.08	1.06	1.06	1.06	1.06
		500	1.10	1.08	1.07	1.06	1.07
		600	1.12	1.09	1.08	1.08	1.09
	30	400	1.10	1.08	1.07	1.07	1.07
		500	1.11	1.08	1.07	1.07	1.08
		600	1.14	1.10	1.09	1.09	1.10
	45	400	1.14	1.11	1.10	1.09	1.09
		500	1.16	1.12	1.10	1.09	1.10
		600	1.18	1.14	1.12	1.12	1.13
	60	400	1.24	1.19	1.17	1.15	1.16
		500	1.26	1.20	1.17	1.15	1.17
		600	1.26	1.21	1.18	1.17	1.17

F4-34-VI-114-1

NEW Figure 6-17 (Sheet 1 of 4)

WRCS DRAG COEFFICIENTS (continued)

F-4D
F-4E

FOR ALL BOMBS $V_e = 0$ fps (0 Volts)

BOMB	DIVE ANGLE DEG	RELEASE TAS KTS	5000 AND BELOW	PICKLE SLANT RANGE (FEET)			
				7500	10,000	15,000	20,000
MK 84 LASER	15	400	1.08	1.07	1.07	1.07	1.08
		500	1.11	1.09	1.09	1.07	1.09
		600	1.13	1.11	1.11	1.11	1.14
	30	400	1.10	1.09	1.08	1.08	1.08
		500	1.11	1.09	1.08	1.09	1.10
		600	1.13	1.12	1.11	1.13	1.15
	45	400	1.15	1.12	1.12	1.11	1.12
		500	1.17	1.13	1.12	1.11	1.14
		600	1.22	1.16	1.15	1.16	1.17
	60	400	1.24	1.20	1.19	1.18	1.20
		500	1.26	1.21	1.18	1.18	1.21
		600	1.25	1.23	1.21	1.21	1.23
M 118 GP	15	400	1.05	1.05	1.05	1.05	1.06
		500	1.07	1.06	1.05	1.03	1.07
		600	1.09	1.08	1.08	1.10	1.12
	30	400	1.07	1.06	1.06	1.05	1.07
		500	1.07	1.06	1.05	1.06	1.08
		600	1.10	1.09	1.09	1.11	1.14
	45	400	1.09	1.07	1.07	1.06	1.08
		500	1.10	1.08	1.08	1.09	1.10
		600	1.13	1.12	1.12	1.14	1.18
	60	400	1.16	1.13	1.12	1.11	1.11
		500	1.22	1.14	1.12	1.12	1.13
		600	1.18	1.16	1.16	1.18	1.18
M 118 LASER	15	400	1.06	1.06	1.06	1.07	1.08
		500	1.09	1.07	1.07	1.08	1.10
		600	1.10	1.09	1.10	1.12	1.15
	30	400	1.07	1.06	1.06	1.07	1.09
		500	1.09	1.07	1.07	1.08	1.11
		600	1.11	1.11	1.11	1.14	1.18
	45	400	1.10	1.09	1.08	1.09	1.11
		500	1.12	1.10	1.10	1.11	1.14
		600	1.14	1.13	1.14	1.17	1.22
	60	400	1.17	1.15	1.14	1.14	1.16
		500	1.19	1.16	1.15	1.16	1.18
		600	1.20	1.17	1.18	1.21	1.25
BDU-33/B (SUU-20/A)	15	400	1.18	1.16	1.18	1.20	1.24
		500	1.22	1.21	1.19	1.25	1.32
		600	1.29	1.27	1.29	1.37	1.45
	30	400	1.22	1.20	1.19	1.24	1.28
		500	1.26	1.23	1.24	1.28	1.37
		600	1.33	1.31	1.34	1.40	1.50
	45	400	1.28	1.25	1.25	1.29	1.34
		500	1.33	1.30	1.30	1.34	1.42
		600	1.40	1.40	1.39	1.42	1.58
	60	400	1.45	1.38	1.39	1.39	1.41
		500	1.49	1.43	1.42	1.46	1.51
		600	1.58	1.50	1.51	1.58	1.66
BDU-33/B (SUU-21/A)	15	400	1.13	1.13	1.14	1.17	1.22
		500	1.15	1.16	1.17	1.22	1.29
		600	1.21	1.22	1.24	1.33	1.40
	30	400	1.14	1.14	1.16	1.20	1.29
		500	1.16	1.16	1.17	1.24	1.34
		600	1.23	1.24	1.26	1.36	1.47
	45	400	1.17	1.17	1.18	1.22	1.29
		500	1.21	1.21	1.23	1.29	1.38
		600	1.27	1.27	1.31	1.41	1.43
	60	400	1.28	1.24	1.26	1.30	1.35
		500	1.31	1.29	1.30	1.35	1.43
		600	1.48	1.35	1.37	1.47	1.58

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F4-34-VI-114-2

Figure 6-17 (Sheet 2 of 4) NEW

WRCS DRAG COEFFICIENTS F-4D F-4E (CONTINUED)

FOR ALL BOMBS V_e = 0 fps (0 Volts)

BOMB	DIVE ANGLE DEG	RELEASE TAS KTS	5000 AND BELOW	PICKLE SLANT RANGE (FEET) 7500	10,000	15,000	20,000
BDU-33A/B (SUU-21/A)	15	400	1.12	1.13	1.14	1.24	1.24
		500	1.15	1.15	1.16	1.21	1.27
		600	1.17	1.17	1.18	1.23	1.28
	30	400	1.14	1.14	1.15	1.20	1.24
		500	1.16	1.15	1.16	1.21	1.28
		600	1.19	1.18	1.19	1.25	1.30
	45	400	1.17	1.16	1.17	1.20	1.25
		500	1.19	1.18	1.19	1.23	1.28
		600	1.22	1.20	1.21	1.25	1.31
	60	400	1.27	1.24	1.24	1.27	1.31
		500	1.30	1.26	1.26	1.28	1.32
		600	1.31	1.27	1.27	1.30	1.34
BDU-33A/B (SUU-20/A)	15	400	1.18	1.17	1.18	1.21	1.25
		500	1.22	1.20	1.18	1.24	1.29
		600	1.25	1.22	1.23	1.27	1.33
	30	400	1.22	1.20	1.20	1.24	1.27
		500	1.25	1.22	1.22	1.25	1.31
		600	1.29	1.25	1.25	1.29	1.34
	45	400	1.28	1.24	1.24	1.26	1.30
		500	1.32	1.27	1.26	1.28	1.32
		600	1.35	1.30	1.29	1.31	1.36
	60	400	1.44	1.37	1.36	1.36	1.38
		500	1.48	1.40	1.37	1.38	1.40
		600	1.51	1.42	1.39	1.40	1.42
ROCKEYE II (8 BOMB RIPPLE)	45	500	–	–	1.40	–	–
		550	–	–	1.41	–	–
FINNED BLU-27/B	15	400	1.01	1.03	1.05	—	–
		500	1.01	1.03	1.05	1.09	1.11
		600	1.02	1.05	1.07	1.11	1.15
	30	400	1.01	1.03	1.05	1.07	1.09
		500	1.01	1.03	1.05	1.08	1.10
		600	1.02	1.05	1.08	1.14	1.19
	45	400	1.01	1.03	1.04	1.07	1.09
		500	1.00	1.03	1.04	1.08	1.11
		600		1.06	1.10	1.17	1.24
	60	400	–	1.02	1.03	1.06	1.08
		500	–	1.02	1.04	1.08	1.13
		600	–	1.06	1.11	1.20	1.29
UNFINNED BLU-27/B	15	400	1.45	1.80	–	–	–
		500	1.44	1.79	2.20	–	–
		600	1.42	1.78	2.19	3.12	–
	30	400	1.44	1.77	2.12	—	–
		500	1.43	1.77	2.15	2.93	
		600	1.41	1.75	2.15	2.99	3.80
	45	400	1.44	1.76	2.10	2.71	3.13
		500	1.43	1.76	2.12	2.87	3.52
		600	–	1.75	2.13	2.92	3.66
	60	400	–	1.76	2.08	2.68	3.17
		500	–	1.76	2.12	2.82	3.42
		600	–	1.76	2.13	2.89	3.57

4C-34-1-1-(199-3)

Figure 6-17 (Sheet 3 of 4)

WRCS DRAG COEFFICIENTS F-4D F-4E (CONTINUED)

CBU-24A/B, OR -29A/B DISPENSER AND BOMB

PULLUP	PICKLE		(C_B) SETTING
	DIVE ANGLE (DEG)	SLANT RANGE/1000 (FEET)	
3.0 G	15 15	20 15	1.39 1.99
	30 30	20 15	1.33 1.61
	45 45 45	20 15 10	1.29 1.41 1.96
4.0 G	15 15	20 15	1.35 1.76
	30 30 30	20 15 10	1.30 1.52 2.78
	45 45 45	20 15 10	1.27 1.42 1.83
5.0 G	15 15	20 15	1.32 1.67
	30 30 30	20 15 10	1.28 1.47 2.49
	45 45 45	20 15 10	1.26 1.35 1.78
6.0 G	15 15	20 15	1.30 1.61
	30 30 30	20 15 10	1.27 1.45 2.34
	45 45 45	20 15 10	1.25 1.34 1.74

Notes

- Each C_B value is optimized for the ranges listed. C_b is based on a constant V_e setting for all bombs. The V_e potentiometer setting on the ballistics computer must be adjusted to zero feet per second by the ground crew.
- The following ejector rack delay time bias settings must be used:
  T_{ea} = 95 msec
  T_{eg} and T_{ev} = 75 msec
- Some aircraft may consistently experience a long or short bomb range impact error. A long range bias error may be compensated for by positioning the pipper short of the target at pickle or by using the release advance control on the WRCS control panel. Short range bias error can be compensated for only by positioning the pipper beyond the target at pickle.
- Refer to WRCS Ballistic Data, this section.

4C-34-1-1-(199-4)

Figure 6-17 (Sheet 4 of 4)

"All data on page 6-56 deleted."

WRCS DRAG COEFFICIENTS F-4D F-4E

M117 RETARDED

FOUR BOMB RIPPLE RELEASE 0.06 SEC RELEASE INTERVAL
RELEASE ADVANCE SETTING - 90 MILLISECONDS
4.0 G PULLOUT

PICKLE CONDITIONS TRUE AIRSPEED (KNOTS)	DIVE ANG (DEG)	ALT (FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	BOMB TIME OF FALL (SEC)	IMPACT STICK LENGTH (FT)	CB SETTING
450	15	1000	2.10	652	- 7	5.8	190	2.65
		1500	3.54	1113	+ 3	11.7	180	4.86
500	15	1000	1.98	621	- 8	5.0	190	2.51
		1500	3.18	1034	- 1	10.1	190	4.70
550	15	1000	1.80	606	-10	4.4	180	2.39
		1500	2.88	979	- 4	8.9	210	4.53
450	30	1500	1.56	923	-26	3.7	100	1.93
		2000	2.04	1270	-23	6.5	140	2.81
		2500	2.64	1610	-18	8.8	160	3.91
		3000	3.24	1980	-14	11.8	170	5.16
		3500	4.02	2380	- 9	15.0	170	6.53
		4000	4.80	2800	- 3	18.5	160	7.98
500	30	2000	1.92	1230	-24	5.3	140	2.67
		2500	2.40	1570	-21	7.8	160	3.76
		3000	3.00	1900	-17	10.4	180	5.02
		3500	3.66	2250	-13	13.3	180	6.41
		4000	4.38	2630	- 8	16.4	180	7.91
		4500	5.10	3068	- 3	19.6	180	9.47
550	30	2000	1.80	1190	-25	4.6	130	2.55
		2500	2.22	1530	-23	6.9	160	3.61
		3000	2.76	1840	-20	9.3	180	4.86
		3500	3.36	2170	-16	11.9	190	6.26
		4000	4.02	2510	-12	14.6	190	7.77
		4500	4.68	2900	- 9	17.5	200	9.37
450	45	3500	2.28	2310	-36	8.8	140	3.97
		4000	2.70	2620	-33	10.8	150	4.89
		4500	3.06	2970	-30	12.9	160	5.87
		5000	3.48	3310	-27	15.1	170	6.91
		5500	3.90	3660	-24	17.4	170	7.98
		6000	4.32	4030	-22	19.6	170	9.08
500	45	3500	2.16	2240	-38	7.8	140	3.83
		4000	2.52	2550	-35	9.7	150	4.75
		4500	2.88	2870	-32	11.6	160	5.75
		5000	3.24	3200	-30	13.6	170	6.81
		5500	3.66	3520	-28	15.6	180	7.92
		6000	4.02	3880	-25	17.8	180	9.08
550	45	4000	2.34	2500	-37	8.8	150	4.60
		4500	2.70	2795	-35	10.4	160	5.61
		5000	3.06	3100	-33	12.4	170	6.67
		5500	3.42	3420	-31	14.3	180	7.81
		6000	3.78	3740	-29	16.2	190	8.99

4C-34-1-1-(199-6)

Figure 6-17. WRCS DRAG COEFFICIENTS (Sheet 4A of 4)

WRCS DRAG COEFFICIENTS F-4D F-4E

M117 RETARDED

FOUR BOMB RIPPLE RELEASE 0.10 SEC RELEASE INTERVAL
RELEASE ADVANCE SETTING - 150 MILLISECONDS
4.0 G PULLOUT

PICKLE CONDITIONS TRUE AIRSPEED (KNOTS)	DIVE ANG (DEG)	ALT (FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	BOMB TIME OF FALL (SEC)	IMPACT STICK LENGTH (FT)	CB SETTING
450	15	1000	2.10	660	- 7	5.7	310	2.65
		1500	3.50	1120	+ 3	11.7	290	4.86
500	15	1000	1.90	640	- 9	5.0	310	2.51
		1500	3.20	1040	- 1	10.3	320	4.69
550	15	1000	1.80	610	-10	4.4	300	2.39
		1500	2.90	980	- 4	9.0	350	4.51
450	30	1500	1.60	910	-26	3.7	170	1.93
		2000	2.00	1280	-23	6.1	240	2.81
		2500	2.60	1620	-19	8.8	270	3.90
		3000	3.30	1960	-14	11.8	280	5.16
		3500	4.00	2360	- 9	15.0	280	6.53
		4000	4.80	2800	- 3	18.5	270	7.97
500	30	1500	1.70	810	-26	3.3	140	1.84
		2000	1.90	1230	-24	5.3	220	2.67
		2500	2.40	1570	-21	7.8	270	3.76
		3000	3.00	2330	-17	10.4	290	5.02
		3500	3.60	2260	-13	13.2	300	6.41
		4000	4.30	2640	- 9	16.3	300	7.90
		4500	5.10	3070	- 4	19.6	300	9.46
550	30	2000	1.80	1190	-25	4.6	210	2.55
		2500	2.20	1540	-23	6.9	270	3.60
		3000	2.80	1830	-20	9.3	300	4.85
		3500	3.40	2150	-16	11.9	320	6.25
		4000	4.00	2510	-13	14.6	320	7.76
		4500	4.70	2892	- 8	17.5	320	9.36
450	45	3500	2.30	2300	-36	8.8	230	3.98
		4000	2.70	2620	-33	10.8	250	4.91
		4500	3.10	2960	-30	12.9	270	5.88
		5000	3.50	3300	-27	15.1	280	6.91
		5500	3.90	3670	-24	17.4	280	7.99
		6000	4.30	4040	-21	19.7	290	9.09
500	45	3500	2.20	2220	-37	7.8	230	3.84
		4000	2.50	2560	-35	9.7	250	4.75
		4500	2.90	2860	-33	11.6	270	5.76
		5000	3.20	3220	-31	13.7	290	6.82
		5500	3.60	3550	-28	15.7	300	7.94
		6000	4.00	3890	-26	17.8	300	9.09
550	45	4000	2.30	2530	-37	8.8	250	4.61
		4500	2.70	2800	-35	10.5	270	5.62
		5000	3.00	3130	-33	12.5	290	6.69
		5500	3.40	3430	-30	14.3	300	7.82
		6000	3.80	3730	-28	16.2	310	9.00

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Figure 6-17. WRCS DRAG COEFFICIENTS (Sheet 4B of 4)

WRCS DRAG COEFFICIENTS F-4D F-4E

MK 82 SNAKEYE I (RETARDED)

SEVEN BOMB RIPPLE RELEASE 0.06 SEC RELEASE INTERVAL
RELEASE ADVANCE SETTING - 180 MILLISECONDS
4.0 G PULLOUT

PICKLE CONDITIONS TRUE AIRSPEED (KNOTS)	DIVE ANG (DEG)	ALT (FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	BOMB TIME OF FALL (SEC)	IMPACT STICK LENGTH (FT)	CB SETTING
450	15	1000	1.98	660	- 8	5.3	390	2.19
		1500	3.18	1100	+ 1	10.6	380	3.77
500	15	1000	1.86	640	-10	4.6	380	2.10
		1500	2.88	1040	- 3	9.3	430	3.65
450	30	1500	1.44	970	-26	3.5	190	1.70
		2000	1.92	1310	-23	5.6	280	2.31
		2500	2.40	1670	-20	8.2	330	3.09
		3000	2.94	2040	-16	10.9	350	3.98
		3500	3.60	2410	-12	13.7	350	4.93
		4000	4.32	2820	- 7	16.8	350	5.97
		4500	5.10	3280	- 1	20.3	330	7.03
500	30	1500	1.38	930	-27	3.0	170	1.63
		2000	1.80	1270	-24	4.9	265	2.22
		2500	2.22	1630	-22	7.2	330	2.97
		3000	2.70	1980	-19	9.7	360	3.87
		3500	3.30	2310	-16	12.1	370	4.82
		4000	3.96	2680	-11	15.0	380	5.90
		4500	4.62	3090	- 7	17.8	380	7.02
		5000	5.34	3540	- 2	21.1	360	8.17
		5500	6.12	4040	+ 3	24.6	350	9.32
450	45	3500	2.10	2400	-37	8.1	280	3.11
		4000	2.46	2730	-34	10.0	310	3.75
		4500	2.76	3100	-32	11.9	330	4.45
		5000	3.12	3450	-30	13.9	340	5.19
		5500	3.54	3790	-27	16.0	350	5.95
		6000	3.92	4150	-24	18.0	360	6.71
		6500	4.34	4520	-21	20.2	360	7.51
		7000	4.70	4930	-19	22.4	360	8.30
		7500	5.18	5320	-15	24.8	360	9.10
		8000	5.60	5740	-12	27.2	350	9.87
500	45	3500	1.98	2340	-39	7.2	270	3.00
		4000	2.28	2680	-37	8.9	300	3.65
		4500	2.58	3020	-35	10.8	330	4.35
		5000	2.94	3350	-32	12.6	340	5.11
		5500	3.30	3680	-30	14.5	360	5.89
		6000	3.68	4010	-28	16.3	370	6.68
		6500	4.04	4360	-25	18.3	380	7.52
		7000	4.40	4730	-23	20.4	380	8.38
		7500	4.76	5110	-21	22.4	390	9.24

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Figure 6-17. WRCS DRAG COEFFICIENTS (Sheet 4C of 4)

WRCS DRAG COEFFICIENTS F-4D F-4E

MK 82 SNAKEYE I (RETARDED)

SEVEN BOMB RIPPLE RELEASE 0.10 SEC RELEASE INTERVAL
RELEASE ADVANCE SETTING - 300 MILLISECONDS
4.0 G PULLOUT

PICKLE CONDITIONS TRUE AIRSPEED (KNOTS)	DIVE ANG (DEG)	ALT (FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	BOMB TIME OF FALL (SEC)	IMPACT STICK LENGTH (FT)	CB SETTING
450	15	1000	2.00	660	- 8	5.3	640	2.18
		1500	3.20	1100	+ 1	10.7	630	3.77
500	15	1000	1.80	650	-10	4.6	620	2.09
		1500	2.90	1040	- 3	9.3	690	3.64
450	30	1500	1.50	950	-26	3.5	320	1.69
		2000	1.90	1310	-24	5.6	470	2.30
		2500	2.40	1670	-20	8.1	550	3.08
		3000	3.00	2030	-16	10.9	580	3.97
		3500	3.60	2410	-12	13.7	590	4.93
		4000	4.30	2820	- 7	16.8	580	5.96
		4500	5.10	3280	- 1	20.3	550	7.03
500	30	1500	1.40	920	-27	3.0	280	1.62
		2000	1.80	1270	-25	4.9	440	2.20
		2500	2.20	1630	-22	7.2	550	2.97
		3000	2.70	1980	-19	9.6	600	3.86
		3500	3.30	2320	-15	12.1	620	4.82
		4000	3.90	2693	-12	14.9	630	5.89
		4500	4.60	3100	- 7	17.9	620	7.02
		5000	5.30	3540	- 3	21.0	610	8.17
		5500	6.10	4050	+ 2	24.6	580	9.32
450	45	3500	2.10	2400	-37	8.1	460	3.10
		4000	2.50	2710	-34	9.9	510	3.75
		4500	2.80	3080	-32	11.9	540	4.45
		5000	3.10	3460	-30	13.9	570	5.18
		5500	3.50	3810	-27	16.0	580	5.95
		6000	3.90	4170	-24	18.1	590	6.73
		6500	4.30	4550	-21	20.3	600	7.53
		7000	4.70	4940	-18	22.5	600	8.33
		7500	5.10	5350	-16	24.8	590	9.12
		8000	5.60	5730	-12	27.2	590	9.87
500	45	3500	2.00	2330	-39	7.2	440	3.00
		4000	2.30	2660	-37	8.9	500	3.64
		4500	2.60	3010	-35	10.7	540	4.35
		5000	2.90	3360	-33	12.6	570	5.10
		5500	3.30	3680	-30	14.5	600	5.89
		6000	3.60	4050	-28	16.4	610	6.71
		6500	4.00	4390	-25	18.4	630	7.55
		7000	4.40	4740	-23	20.4	640	8.41
		7500	4.80	5110	-20	22.5	640	9.27

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Figure 6-17. WRCS DRAG COEFFICIENTS (Sheet 4D of 4)

EXPOSURE TIME CHART

FOR DIVE BOMBING

DIVE ANGLE - 45°; ROLL IN ALTITUDE - 12,000 FT; RELEASE ALTITUDE - 7,000 FT;
4.0 G RECOVERY WITH A 30° CLIMB OUT ANGLE.

RELEASE TAS KTS	ALTITUDE* COST DURING PULLOUT	EXPOSURE TIME IN SECONDS					
		BELOW 9500 FT	BELOW 8500 FT	BELOW 7500 FT	BELOW 6500 FT	BELOW 5500 FT	BELOW 4500 FT
450	2420	26.3	22.0	17.7	13.3	8.8	---
500	2920	26.4	22.6	18.8	15.0	11.0	5.9
550	3450	27.0	23.5	20.1	16.6	13.0	8.9
5.0 G RECOVERY WITH A 30° CLIMB OUT ANGLE							
450	1910	24.5	19.6	14.9	10.3	5.2	---
500	2310	23.4	19.4	15.7	11.4	7.2	---
550	2730	23.4	19.8	16.2	12.6	8.9	3.8

- These time exposure data assume that a 4.0 G recovery is attained 2.0 seconds after release. The G is maintained until a 30 degree climb out is attained.

Note

NO POWER ADVANCE WAS ASSUMED UNTIL THE NOSE OF THE AIRCRAFT PASSED THROUGH THE HORIZON. MAXIMUM POWER WAS APPLIED AS THE NOSE OF THE AIRCRAFT PASSED THROUGH THE HORIZON.

* The values listed for altitude lost during pullout are based on a starting altitude of 7000 feet.

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Figure 6-18 (Sheet 1 of 2)

EXPOSURE TIME CHART — FOR LOFT BOMBING

APPROACH TAS-KNOTS	REL. ANGLE DEGREES	TIME TO PERFORM MANEUVER AND ESCAPE: EXP. TIME ABOVE 500 FT SECONDS	EXP. TIME ABOVE 1000 FT SECONDS	EXP. TIME ABOVE 1500 FT SECONDS	EXP. TIME ABOVE 2000 FT SECONDS	MAX ALT. GAINED FEET	HORIZONTAL RANGE A/C TO TGT. AT BOMB IMPACT FEET
300	15	14	—	—	—	1050	2563
	20	16	9	—	—	1329	3523
	25	20	16	5	—	1626	4504
	30	25	22	12	—	1968	5420
	35	29	24	21	10	2338	6133
	40	37	34	32	19	2703	6655
	45	42	39	36	28	3070	6838
350	15	16	5	—	—	1217	3995
	20	21	12	3	—	1569	5705
	25	27	20	11	—	1952	7413
	30	34	26	19	9	2368	8989
	35	37	34	28	18	2759	10250
	40	41	37	33	27	2964	11330
	45	45	43	40	36	3592	12045
400	15	16	9	—	—	1419	4896
	20	28	17	8	—	1880	7235
	25	33	24	17	8	2359	9763
	30	40	26	26	17	2855	12457
	35	49	42	36	30	3384	14988
	40	57	49	43	36	3936	17153
	45	64	57	51	44	4389	18903
450	15	19	11	—	—	1523	5865
	20	25	20	14	4	2201	8813
	25	34	30	23	15	2759	12073
	30	47	38	32	25	3498	15458
	35	54	48	40	35	3956	18725
	40	64	57	51	44	4682	21872
	45	72	66	56	50	5453	24562

NOTE: This chart is based on an approach altitude of 300 feet. For other approach altitudes, add the difference to the Exposure Time altitude valves stated on this chart, i.e. for a 500-foot approach, the difference (500-300) is +200 feet. The exposure time above 700 is obtained from the Exposure Time above 500 feet column.

EXAMPLE 1:

Approach altitude: 300 feet
Approach TAS: 300 knots
Release Angle: 15 degrees
FIND:
Exposure Time above 500 feet: 14 seconds
Maximum Altitude Gained: 1050 feet
Horizontal Range from Aircraft to Target at Bomb Impact: 2563 feet

EXAMPLE 2:

Approach altitude: 500 feet
Approach TAS: 300 knots
Release Angle: 15 degrees
FIND:
Exposure Time above 700 feet: 14 seconds
Maximum Altitude Gained: 1050 feet
Horizontal Range from Aircraft to Target at Bomb Impact: 2563 feet

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Figure 6-18 (Sheet 2 of 2)

LOFT BOMBING WIND CORRECTION

APPROACH TAS-KNOTS	REL ANGLE DEGREES	PULLUP TIMER CORRECTION – SECONDS							
		5 KNOTS	10 KNOTS	15 KNOTS	20 KNOTS	25 KNOTS	30 KNOTS	35 KNOTS	40 KNOTS
	15	0.2	0.4	0.6	0.9	1.0	1.3	1.5	1.7
	20	0.3	0.5	0.8	1.0	1.3	1.5	1.8	2.0
	25	0.3	0.6	0.9	1.2	1.6	1.9	2.2	2.5
300	30	0.4	0.8	1.1	1.5	1.8	2.2	2.5	2.9
	35	0.4	0.9	1.2	1.6	2.0	2.5	2.9	3.3
	40	0.4	1.0	1.3	1.8	2.2	2.7	3.1	3.6
	45	0.5	1.2	1.5	1.9	2.4	2.9	3.4	3.9
	15	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6
	20	0.3	0.5	0.7	1.0	1.2	1.5	1.8	2.0
	25	0.3	0.6	0.8	1.1	1.4	1.7	2.0	2.3
350	30	0.3	0.7	1.0	1.3	1.6	2.0	2.3	2.7
	35	0.4	0.8	1.1	1.5	1.9	2.3	2.7	3.0
	40	0.4	0.8	1.2	1.7	2.1	2.5	2.9	3.3
	45	0.4	0.9	1.3	1.8	2.2	2.8	3.1	3.6
	15	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6
	20	0.2	0.5	0.7	1.0	1.2	1.5	1.7	1.9
	25	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4
400	30	0.3	0.7	1.0	1.4	1.7	2.1	2.4	2.8
	35	0.4	0.8	1.2	1.6	2.0	2.4	2.7	3.1
	40	0.4	0.9	1.3	1.7	2.1	2.6	3.0	3.4
	45	0.5	0.9	1.4	1.8	2.3	2.8	3.3	3.7
	15	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6
	20	0.3	0.5	0.8	1.0	1.3	1.5	1.8	2.1
	25	0.3	0.6	0.9	1.2	1.5	1.9	2.2	2.5
450	30	0.4	0.7	1.1	1.4	1.8	2.1	2.5	2.9
	35	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.2
	40	0.4	0.9	1.3	1.8	2.2	2.7	3.1	3.6
	45	0.5	1.0	1.5	1.9	2.4	2.9	3.4	3.9

Note Correction is given for the $R_2 + R_3$ range in seconds and is applied to the pullup timer. (Headwind Add, Tailwind Subtract)

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Figure 6-19

WRCS BALLISTIC DATA (G.P. BOMBS)

2.0 G PULLOUT
0.06 SEC RELEASE INTERVAL

PICKLE CONDITIONS				MIDDLE BOMB IN RIPPLE RELEASE							
KNOTS TAS	DIVE ANGLE (DEG)	SLANT RANGE (1000 FT)	ALT AGL (FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALT (FT)	RELEASE ANGLE (DEG)	TIME RELEASE TO IMPACT (SEC)	3 BOMB STICK LENGTH (FT)	6 BOMB STICK LENGTH (FT)	8 BOMB STICK LENGTH (FT)	12 BOMB STICK LENGTH (FT)
450	20	10	3420	4.34	2440	-12	8.2	120	300	430	670
		15	5130	6.02	3920	- 8	12.6	210	380	530	840
		20	6840	7.82	5490	- 4	17.0	170	420	590	930
	30	10	5000	3.92	3600	-23	8.2	100	240	340	540
		15	7500	5.36	5680	-19	12.3	130	320	460	710
		20	10000	6.74	7830	-16	16.4	150	380	540	840
	45	10	7070	3.24	5330	-39	8.3	80	200	280	440
		15	10610	4.26	8350	-36	12.4	110	280	390	610
		20	14140	5.22	11420	-34	16.3	140	340	480	750
500	20	10	3420	3.98	2390	-14	7.4	120	290	410	640
		15	5130	5.54	3820	-10	11.4	150	380	530	840
		20	6840	7.10	5320	- 7	15.3	180	440	610	960
	30	10	5000	3.68	3510	-24	7.4	90	230	320	510
		15	7500	4.94	5580	-21	11.2	130	320	440	690
		20	10000	6.26	7680	-18	15.0	150	380	530	830
	45	10	7070	3.06	5239	-40	7.6	80	190	260	410
		15	10610	4.02	8230	-37	11.5	110	260	370	580
		20	14140	4.98	11240	-35	15.2	130	330	460	710
550	20	10	3420	3.74	2330	-15	6.7	110	280	390	620
		15	5130	5.18	3730	-12	10.4	150	370	520	820
		20	6840	6.62	5190	- 9	14.1	180	440	620	970
	30	10	5000	3.44	3460	-25	6.8	90	220	310	480
		15	7500	4.70	5460	-22	10.4	120	300	420	660
		20	10000	5.96	7510	-20	14.0	150	370	510	810
	45	10	7070	2.94	5130	-41	7.0	70	170	240	380
		15	10610	3.84	8100	-38	10.7	100	250	350	540
		20	14140	4.80	11050	-36	14.4	120	310	430	680
600	20	10	3420	3.56	2270	-15	6.2	110	270	380	590
		15	5130	4.88	3650	-13	9.7	150	360	510	800
		20	6840	6.26	5070	-10	13.2	170	430	600	950
	30	10	5000	3.26	3400	-26	6.3	80	210	290	450
		15	7500	4.52	5340	-23	9.7	110	290	400	630
		20	10000	5.72	7370	-21	13.3	140	350	490	770
	45	10	7070	2.82	5050	-41	6.5	70	160	230	360
		15	10610	3.72	7960	-39	10.2	90	230	330	510
		20	14140	4.68	10860	-37	13.7	120	290	410	640

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Figure 6-20 (Sheet 1 of 9) NEW

WRCS BALLISTIC DATA (GP BOMBS) continued

3.0 G PULLOUT
0. 06 SEC RELEASE INTERVAL

PICKLE CONDITIONS				MIDDLE BOMB IN RIPPLE RELEASE							
KNOTS TAS	DIVE ANGLE (DEG)	SLANT RANGE (1000 FT)	ALT AGL (FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALT (FT)	RELEASE ANGLE (DEG)	TIME RELEASE TO IMPACT (SEC)	3 BOMB STICK LENGTH (FT)	6 BOMB STICK LENGTH (FT)	8 BOMB STICK LENGTH (FT)	12 BOMB STICK LENGTH (FT)
450	20	10	3420	3.16	2740	-10	9.5	200	490	690	1080
		15	5130	4.30	4340	- 4	14.7	240	590	830	1300
		20	6840	5.56	6030	+ 2	20.2	250	630	880	1380
	30	10	5000	2.88	3990	-21	9.3	160	400	560	870
		15	7500	3.84	6250	-16	14.1	210	520	720	1140
		20	10000	4.80	8560	-12	18.9	240	590	820	1300
	45	10	7070	2.46	5770	-38	9.2	130	320	450	710
		15	10610	3.12	8990	-34	13.7	180	440	620	970
		20	14140	3.78	12240	-31	18.0	210	530	750	1180
500	20	10	3420	2.92	2690	-12	8.5	190	480	670	1050
		15	5130	3.94	4250	- 8	13.2	240	610	850	1330
		20	6840	5.02	5880	- 3	18.0	270	670	940	1480
	30	10	5000	2.70	3930	-23	8.4	150	380	530	830
		15	7500	3.60	6150	-19	12.8	200	510	710	1120
		20	10000	4.44	8430	-15	17.2	240	600	840	1320
	45	10	7070	2.34	5690	-39	8.4	120	300	420	660
		15	10610	3.00	8870	-36	12.6	170	420	590	930
		20	14140	3.60	12100	-33	16.8	210	520	730	1140
550	20	10	3420	2.74	2640	-13	7.7	190	460	650	1020
		15	5130	3.70	4170	-10	12.1	240	610	850	1330
		20	6840	4.66	5760	- 6	16.4	280	690	970	1530
	30	10	5000	2.58	3860	-24	7.7	140	360	500	790
		15	7500	3.36	6080	-21	11.8	200	490	690	1080
		20	10000	4.20	8310	-17	16.0	240	590	830	1300
	45	10	7070	2.22	5620	-40	7.7	110	280	390	610
		15	10610	2.88	8760	-37	11.8	160	400	560	880
		20	14140	3.48	11950	-35	15.8	200	490	690	1090
600	20	10	3420	2.62	2590	-14	7.1	180	440	620	970
		15	5130	3.52	4100	-11	11.2	240	590	830	1300
		20	6840	4.42	5660	- 8	15.3	280	690	970	1520
	30	10	5000	2.46	3800	-25	7.1	140	340	470	740
		15	7500	3.24	5980	-22	11.1	190	470	660	1030
		20	10000	4.02	8200	-19	15.1	230	570	790	1250
	45	10	7070	2.16	5530	-41	7.2	100	260	370	570
		15	10610	2.76	8670	-38	11.2	150	370	520	820
		20	14140	3.36	11820	-36	15.1	210	470	650	1030

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NEW Figure 6-20 (Sheet 2 of 9)

WRCS BALLISTIC DATA (GP BOMBS) continued

4.0 G PULLOUT
0.06 SEC RELEASE INTERVAL

PICKLE CONDITIONS				MIDDLE BOMB IN RIPPLE RELEASE							
KNOTS TAS	DIVE ANGLE (DEG)	SLANT RANGE (1000 FT)	ALT AGL (FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALT (FT)	RELEASE ANGLE (DEG)	TIME RELEASE TO IMPACT (SEC)	3 BOMB STICK LENGTH (FT)	6 BOMB STICK LENGTH (FT)	8 BOMB STICK LENGTH (FT)	12 BOMB STICK LENGTH (FT)
450	20	10	3420	2.58	2870	- 9	10.1	270	660	930	1460
		15	5130	3.48	4510	- 2	15.9	310	770	1080	1700
		20	6840	4.50	6240	+ 5	22.0	310	770	1080	1700
	30	10	5000	2.42	4160	-20	9.9	220	540	760	1200
		15	7500	3.14	6500	-15	15.1	280	690	970	1520
		20	10000	3.92	8880	- 9	20.3	300	750	1050	1660
	45	10	7070	2.10	5970	-37	9.6	180	440	610	950
		15	10610	2.58	9280	-33	14.3	240	590	830	1310
		20	14140	3.12	12600	-29	18.9	280	710	990	1560
500	20	10	3420	2.40	2820	-11	9.1	260	650	920	1440
		15	5130	3.18	4430	- 6	14.1	330	820	1140	1800
		20	6840	4.02	6100	- 1	19.4	350	880	1230	1930
	30	10	5000	2.24	4120	-22	8.9	210	520	730	1140
		15	7500	2.90	6420	-18	13.6	280	690	960	1520
		20	10000	3.56	8770	-14	18.3	320	800	1120	1760
	45	10	7070	1.98	5910	-39	8.7	160	400	560	870
		15	10610	2.46	9190	-35	13.2	230	570	800	1260
		20	14140	2.94	12490	-32	17.5	280	700	980	1540
550	20	10	3420	2.28	2780	-13	8.2	260	640	890	1400
		15	5130	3.00	4360	- 8	12.9	330	830	1160	1820
		20	6840	3.72	6000	- 4	17.6	380	940	1310	2060
	30	10	5000	2.18	4040	-23	8.1	200	500	690	1080
		15	7500	2.78	6340	-20	12.5	270	680	950	1490
		20	10000	3.38	8660	-16	16.9	320	810	1130	1770
	45	10	7070	1.92	5830	-39	8.1	150	370	510	800
		15	10610	2.40	9080	-37	12.3	220	550	760	1200
		20	14140	2.82	12380	-34	16.5	270	670	940	1480
600	20	10	3420	2.22	2720	-14	7.6	250	620	860	1350
		15	5130	2.88	4300	-10	12.0	330	810	1140	1790
		20	6840	3.54	5910	- 6	16.3	380	940	1320	2070
	30	10	5000	2.06	4000	-24	7.5	190	460	640	1000
		15	7500	2.66	6260	-21	11.7	260	650	900	1420
		20	10000	3.26	8560	-18	16.0	310	780	1090	1720
	45	10	7070	1.86	5750	-40	7.5	140	340	470	730
		15	10610	2.34	8970	-38	11.7	210	520	720	1130
		20	14140	2.76	12250	-35	15.8	260	640	900	1410

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Figure 6-20 (Sheet 3 of 9) NEW

WRCS BALLISTIC DATA (GP BOMBS) continued

2.0 G PULLOUT
0.10 SEC RELEASE INTERVAL

PICKLE CONDITIONS				MIDDLE BOMB IN RIPPLE RELEASE							
KNOTS TAS	DIVE ANGLE (DEG)	SLANT RANGE (1000 FT)	ALT AGL (FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALT (FT)	RELEASE ANGLE (DEG)	TIME RELEASE TO IMPACT (SEC)	3 BOMB STICK LENGTH (FT)	6 BOMB STICK LENGTH (FT)	8 BOMB STICK LENGTH (FT)	12 BOMB STICK LENGTH (FT)
450	20	10	3420	4.30	2450	-12	8.2	200	500	700	1110
		15	5130	6.00	3930	- 8	12.6	250	630	880	1390
		20	6840	7.80	5490	- 4	17.0	280	700	990	1550
	30	10	5000	3.90	3600	-23	8.2	160	410	570	890
		15	7500	5.40	5670	-19	12.3	220	540	760	1190
		20	10000	6.80	7820	-16	16.4	260	640	890	1410
	45	10	7070	3.30	5300	-39	8.3	130	330	470	730
		15	10610	4.30	8330	-36	12.4	180	460	650	1020
		20	14140	5.20	11430	-34	16.3	230	570	790	1250
500	20	10	3420	4.00	2370	-14	7.4	200	490	680	1070
		15	5130	5.50	3820	-10	11.4	250	630	890	1390
		20	6840	7.10	5320	- 7	15.3	290	730	1020	1600
	30	10	5000	3.70	3510	-24	7.4	150	390	540	850
		15	7500	5.00	5560	-21	11.2	210	530	740	1150
		20	10000	6.30	7670	-18	15.0	250	630	880	1390
	45	10	7070	3.10	5220	-40	7.6	120	310	440	680
		15	10610	4.00	8240	-37	11.5	170	440	610	960
		20	14140	5.00	11230	-35	15.2	220	540	760	1190
550	20	10	3420	3.70	2340	-15	6.7	190	470	650	1030
		15	5130	5.20	3720	-12	10.4	250	620	870	1370
		20	6840	6.60	5190	- 9	14.1	290	730	1020	1610
	30	10	5000	3.50	3430	-25	6.7	150	360	510	800
		15	7500	4.70	5460	-22	10.4	200	500	700	1110
		20	10000	5.90	7530	-20	14.0	240	610	850	1340
	45	10	7070	2.90	5160	-41	7.0	120	290	410	640
		15	10610	3.90	8060	-38	10.7	170	410	580	910
		20	14140	4.80	11050	-36	14.4	210	510	720	1130
600	20	10	3420	3.50	2290	-15	6.2	180	440	620	980
		15	5130	4.90	3640	-13	9.7	240	600	840	1330
		20	6840	6.30	5060	-10	13.2	290	720	1010	1580
	30	10	5000	3.30	3380	-26	6.2	140	210	480	750
		15	7500	4.50	5350	-23	9.7	190	480	670	1050
		20	10000	5.70	7370	-21	13.3	230	580	820	1280
	45	10	7070	2.80	5060	-41	6.5	110	270	380	600
		15	10610	3.70	7980	-39	10.2	160	390	540	850
		20	14140	4.70	10850	-37	13.7	200	490	680	1070

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NEW Figure 6-20 (Sheet 4 of 9)

WRCS BALLISTIC DATA (GP BOMBS) continued

3.0 G PULLOUT
0.10 SEC RELEASE INTERVAL

PICKLE CONDITIONS				MIDDLE BOMB IN RIPPLE RELEASE							
KNOTS TAS	DIVE ANGLE (DEG)	SLANT RANGE (1000 FT)	ALT AGL (FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALT (FT)	RELEASE ANGLE (DEG)	TIME RELEASE TO IMPACT (SEC)	3 BOMB STICK LENGTH (FT)	6 BOMB STICK LENGTH (FT)	8 BOMB STICK LENGTH (FT)	12 BOMB STICK LENGTH (FT)
450	20	10	3420	3.20	2730	-10	9.6	330	820	1150	1810
		15	5130	4.30	4340	- 4	14.7	400	990	1380	2170
		20	6840	5.50	6030	+ 1	20.0	420	1040	1460	2300
	30	10	5000	2.90	3990	-21	9.3	270	660	920	1450
		15	7500	3.80	6260	-17	14.1	340	860	1200	1880
		20	10000	4.80	8560	-12	18.8	390	980	1370	2160
	45	10	7070	2.50	5750	-37	9.2	210	540	750	1180
		15	10610	3.10	9000	-34	13.6	290	730	1030	1610
		20	14140	3.80	12230	-31	18.0	360	890	1250	1960
500	20	10	3420	2.90	2690	-12	8.5	320	790	1110	1750
		15	5130	3.90	4250	- 8	13.0	400	1000	1410	2210
		20	6840	5.00	5880	- 3	18.0	450	1120	1570	2460
	30	10	5000	2.60	3960	-23	8.4	250	630	880	1380
		15	7500	3.60	6150	-19	12.8	340	850	1180	1860
		20	10000	4.40	8440	-15	17.1	400	1000	1390	2190
	45	10	7070	2.30	5710	-39	8.4	200	500	700	1080
		15	10610	3.00	8870	-36	12.6	280	700	980	1540
		20	14140	3.60	12090	-33	16.7	350	860	1210	1900
550	20	10	3420	2.80	2630	-13	7.8	310	770	1080	1710
		15	5130	3.70	4170	-10	12.1	410	1010	1410	2220
		20	6840	4.60	5760	- 6	16.3	460	1150	1610	2540
	30	10	5000	2.60	3850	-24	7.7	240	600	840	1320
		15	7500	3.40	6060	-21	11.8	330	820	1140	1800
		20	10000	4.20	8310	-17	16.0	390	980	1380	2160
	45	10	7070	2.20	5630	-40	7.7	190	470	650	1000
		15	10610	2.90	8740	-37	11.8	270	660	930	1460
		20	14140	3.50	11930	-35	15.8	330	820	1150	1810
600	20	10	3420	2.60	2590	-14	7.1	290	730	1030	1610
		15	5130	3.50	4100	-11	11.2	390	980	1370	2160
		20	6840	4.40	5660	- 8	15.3	460	1150	1610	2530
	30	10	5000	2.50	3790	-25	7.1	230	560	790	1240
		15	7500	3.30	5960	-22	11.1	310	780	1100	1720
		20	10000	4.00	8210	-19	15.1	380	940	1320	2080
	45	10	7070	2.20	5500	-40	7.2	180	440	600	930
		15	10610	2.80	8640	-38	11.2	250	620	870	1370
		20	14140	3.40	11800	-36	15.1	310	780	1090	1720

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Figure 6-20 (Sheet 5 of 9) NEW

WRCS BALLISTIC DATA (GP BOMBS) continued

4.0 G PULLOUT
0.10 SEC RELEASE INTERVAL

PICKLE CONDITIONS				MIDDLE BOMB IN RIPPLE RELEASE							
KNOTS TAS	DIVE ANGLE (DEG)	SLANT RANGE (1000 FT)	ALT AGL (FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALT (FT)	RELEASE ANGLE (DEG)	TIME RELEASE TO IMPACT (SEC)	3 BOMB STICK LENGTH (FT)	6 BOMB STICK LENGTH (FT)	8 BOMB STICK LENGTH (FT)	12 BOMB STICK LENGTH (FT)
450	20	10	3420	2.60	2870	- 9	10.2	450	1100	1550	2430
		15	5130	3.50	4510	- 2	15.9	520	1290	1800	2830
		20	6840	4.50	6240	+ 5	22.0	510	1280	1800	2810
	30	10	5000	2.40	4170	-20	9.8	360	900	1260	1960
		15	7500	3.10	6500	-15	15.0	460	1140	1600	2510
		20	10000	3.90	8880	- 9	20.3	500	1250	1750	2750
	45	10	7070	2.10	5970	-37	9.5	290	720	990	1530
		15	10610	2.60	9280	-33	14.3	400	990	1380	2180
		20	14140	3.10	12610	-30	18.9	470	1180	1650	2590
500	20	10	3420	2.40	2820	-11	9.0	440	1080	1520	2370
		15	5130	3.20	4430	- 6	14.1	550	1360	1900	2990
		20	6840	4.00	6100	- 1	19.3	590	1460	2050	3220
	30	10	5000	2.30	4100	-22	8.9	350	870	1210	1880
		15	7500	2.90	6420	-18	13.6	460	1150	1600	2520
		20	10000	3.60	8760	-13	18.3	540	1340	1870	2940
	45	10	7070	2.00	5900	-38	8.7	270	660	910	1410
		15	10610	2.50	9170	-35	13.2	380	960	1340	2100
		20	14140	2.90	12510	-32	17.5	470	1160	1630	2570
550	20	10	3420	2.30	2770	-13	8.2	430	1060	1480	2300
		15	5130	3.00	4360	- 8	12.8	550	1370	1920	3020
		20	6840	3.70	6000	- 4	17.5	620	1550	2170	3410
	30	10	5000	2.20	4040	-23	8.1	330	820	1140	1770
		15	7500	2.80	6330	-19	12.5	450	1120	1570	2470
		20	10000	3.40	8660	-16	17.0	540	1340	1880	2950
	45	10	7070	1.90	5840	-40	8.1	240	600	830	1280
		15	10610	2.40	9070	-37	12.3	360	910	1270	1980
		20	14140	2.80	12390	-34	16.5	450	1120	1570	2460
600	20	10	3420	2.20	2730	-14	7.6	410	1010	1400	2180
		15	5130	2.90	4290	-10	12.0	550	1360	1900	2980
		20	6840	3.50	5920	- 7	16.2	630	1560	2180	3420
	30	10	5000	2.10	3990	-24	7.5	310	760	1060	1640
		15	7500	2.70	6250	-21	11.8	430	1080	1510	2370
		20	10000	3.30	8550	-18	16.0	520	1300	1820	2870
	45	10	7070	1.90	5720	-40	7.5	230	560	780	1200
		15	10610	2.30	9000	-38	11.7	340	850	1190	1850
		20	14140	2.80	12220	-35	15.8	430	1670	1500	2350

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NEW Figure 6-20 (Sheet 6 of 9)

WRCS BALLISTIC DATA (GP BOMBS) continued

2.0 G PULLOUT
0. 14 SEC RELEASE INTERVAL

PICKLE CONDITIONS				MIDDLE BOMB IN RIPPLE RELEASE							
KNOTS TAS	DIVE ANGLE (DEG)	SLANT RANGE (1000 FT)	ALT AGL (FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALT (FT)	RELEASE ANGLE (DEG)	TIME RELEASE TO IMPACT (SEC)	3 BOMB STICK LENGTH (FT)	6 BOMB STICK LENGTH (FT)	8 BOMB STICK LENGTH (FT)	12 BOMB STICK LENGTH (FT)
450	20	10	3420	4.28	2450	-12	8.2	280	700	980	1540
		15	5130	6.10	3910	- 8	12.6	360	890	1240	1950
		20	6840	7.78	5490	- 4	17.0	390	980	1380	2160
	30	10	5000	3.98	3580	-23	8.2	230	570	800	1250
		15	7500	5.38	5670	-19	12.3	300	760	1060	1670
		20	10000	6.78	7820	-16	16.4	360	890	1250	1960
	45	10	7070	3.20	5350	-39	8.3	190	470	650	1030
		15	10610	4.32	8320	-36	12.4	260	650	910	1420
		20	14140	5.30	11380	-33	16.3	320	790	1110	1750
500	20	10	3420	4.00	2380	-14	7.4	270	680	950	1500
		15	5130	5.54	3820	-10	11.4	360	890	1240	1950
		20	6840	7.08	5320	- 7	15.3	410	1020	1420	2240
	30	10	5000	3.70	3510	-24	7.4	220	540	750	1190
		15	7500	4.96	5570	-21	11.2	290	730	1030	1610
		20	10000	6.22	7690	-18	15.0	350	880	1230	1940
	45	10	7070	3.06	5240	-40	7.6	170	440	610	960
		15	10610	4.04	8220	-37	11.5	250	610	860	1350
		20	14140	5.02	11210	-35	15.2	300	760	1060	1670
550	20	10	3420	3.72	2340	-15	6.7	260	650	910	1440
		15	5130	5.12	3736	-12	10.4	350	870	1220	1910
		20	6840	6.66	5180	- 9	14.1	410	1030	1440	2260
	30	10	5000	3.42	3460	-25	6.8	200	510	710	1120
		15	7500	4.68	5470	-22	10.4	280	700	980	1550
		20	10000	5.94	7520	-20	14.0	340	850	1200	1880
	45	10	7070	2.92	5150	-41	7.0	160	410	570	890
		15	10610	3.90	8060	-38	10.7	230	580	810	1270
		20	14140	4.74	11080	-36	14.4	290	720	1010	1580
600	20	10	3420	3.58	2270	-15	6.1	250	620	870	1370
		15	5130	4.84	3660	-13	9.6	340	840	1180	1850
		20	6840	6.24	5070	-11	13.2	400	1000	1400	2200
	30	10	5000	3.28	3390	-26	6.3	190	480	670	1050
		15	7500	4.54	5330	-23	9.7	270	670	930	1470
		20	10000	5.66	7390	-21	13.3	320	820	1140	1800
	45	10	7070	2.78	5070	-41	6.6	150	380	530	830
		15	10610	3.76	7940	-39	10.1	220	540	760	1190
		20	14140	4.74	10820	-37	13.7	270	680	950	1500

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Figure 6-20 (Sheet 7 of 9) NEW

WRCS BALLISTIC DATA (GP BOMBS) continued

3.0 G PULLOUT
0.14 SEC RELEASE INTERVAL

PICKLE CONDITIONS				MIDDLE BOMB IN RIPPLE RELEASE							
KNOTS TAS	DIVE ANGLE (DEG)	SLANT RANGE (1000 FT)	ALT AGL (FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALT (FT)	RELEASE ANGLE (DEG)	TIME RELEASE TO IMPACT (SEC)	3 BOMB STICK LENGTH (FT)	6 BOMB STICK LENGTH (FT)	8 BOMB STICK LENGTH (FT)	12 BOMB STICK LENGTH (FT)
450	20	10	3420	3.14	2740	-10	9.5	460	1130	1590	2500
		15	5130	4.26	4340	- 5	14.6	550	1370	1920	3010
		20	6840	5.52	6020	+ 1	20.0	580	1450	2040	3220
	30	10	5000	2.90	3980	-21	9.3	370	920	1290	2030
		15	7500	3.88	6230	-16	14.1	480	1200	1680	2640
		20	10000	4.86	8550	-12	18.9	550	1370	1920	3020
	45	10	7070	2.46	5770	-38	9.2	300	750	1040	1610
		15	10610	3.16	8970	-34	13.6	410	1030	1440	2260
		20	14140	3.86	12200	-31	18.0	500	1250	1740	2740
500	20	10	3420	3.00	2670	-12	8.6	450	1120	1570	2470
		15	5130	3.98	4240	- 7	13.2	570	1410	1980	3100
		20	6840	4.96	5870	- 3	17.9	630	1560	2180	3430
	30	10	5000	2.76	3910	-22	8.4	350	880	1230	1940
		15	7500	3.60	6150	-19	12.8	480	1180	1650	2600
		20	10000	4.44	8430	-15	17.1	560	1390	1950	3060
	45	10	7070	2.32	5700	-39	8.4	280	690	960	1480
		15	10610	3.02	8850	-36	12.6	390	980	1370	2160
		20	14140	3.58	12100	-33	16.7	480	1200	1680	2650
550	20	10	3420	2.72	2640	-13	7.7	430	1060	1490	2340
		15	5130	3.70	4170	-10	12.0	570	1400	1970	3090
		20	6840	4.68	5750	- 6	16.4	650	1620	2260	3560
	30	10	5000	2.62	3840	-24	7.7	340	830	1170	1820
		15	7500	3.32	6090	-21	11.8	460	1130	1590	2490
		20	10000	4.16	8320	-18	15.9	550	1370	1910	3010
	45	10	7070	2.32	5560	-40	7.7	260	650	900	1380
		15	10610	2.88	8750	-37	11.8	370	930	1290	2040
		20	14140	3.44	11960	-35	15.8	460	1150	1600	2520
600	20	10	3420	2.58	2600	-14	7.1	410	1020	1430	2220
		15	5130	3.56	4090	-11	11.2	560	1380	1930	3030
		20	6840	4.40	5650	- 8	15.3	650	1600	2240	3530
	30	10	5000	2.48	3790	-25	7.1	320	780	1100	1700
		15	7500	3.32	5950	-22	11.1	440	1090	1530	2410
		20	10000	4.02	8190	-19	15.1	530	1320	1850	2900
	45	10	7070	2.18	5520	-41	7.2	240	600	820	1260
		15	10610	2.74	8680	-38	11.2	350	870	1220	1910
		20	14140	3.44	11770	-36	15.1	440	1090	1530	2400

F4-34-VI-117-8

NEW Figure 6-20 (Sheet 8 of 9)

WRCS BALLISTIC DATA (GP BOMBS) continued

4.0 G PULLOUT
0.14 SEC. RELEASE INTERVAL

PICKLE CONDITIONS				MIDDLE BOMB IN RIPPLE RELEASE							
KNOTS TAS	DIVE ANGLE (DEG)	SLANT RANGE (1000 FT)	ALT AGL (FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALT (FT)	RELEASE ANGLE (DEG)	TIME RELEASE TO IMPACT (SEC)	3 BOMB STICK LENGTH (FT)	6 BOMB STICK LENGTH (FT)	8 BOMB STICK LENGTH (FT)	12 BOMB STICK LENGTH (FT)
450	20	10	3420	2.60	2860	- 9	10.1	620	1530	2150	3350
		15	5130	3.44	4510	- 3	15.7	720	1790	2510	3930
		20	6840	4.56	6240	+ 5	22.1	720	1800	2520	3930
	30	10	5000	2.36	4180	-21	9.8	500	1240	1720	2660
		15	7500	3.20	6480	-15	15.1	650	1610	2250	3540
		20	10000	3.90	8870	- 9	20.2	710	1760	2460	3850
	45	10	7070	2.16	5940	-37	9.6	410	990	1380	2110
		15	10610	2.58	9280	-34	14.2	550	1380	1930	3000
		20	14140	3.14	12580	-30	18.9	660	1650	2310	3620
500	20	10	3420	2.46	2810	-11	9.1	620	1530	2130	3300
		15	5130	3.16	4430	- 6	14.0	760	1880	2640	4140
		20	6840	4.00	6090	- 1	19.2	820	2050	2860	4500
	30	10	5000	2.22	4120	-22	8.8	480	1170	1620	2500
		15	7500	2.92	6410	-18	13.5	640	1600	2240	3520
		20	10000	3.62	8750	-13	18.3	750	1870	2610	4100
	45	10	7070	2.02	5880	-38	8.7	380	900	1250	1920
		15	10610	2.44	9200	-36	13.1	530	1330	1850	2850
		20	14140	3.00	12460	-32	17.5	660	1630	2290	3600
550	20	10	3420	2.32	2760	-13	8.2	600	1470	2040	3160
		15	5130	3.02	4350	- 8	12.8	780	1920	2680	4210
		20	6840	3.72	5990	- 4	17.5	870	2170	3030	4760
	30	10	5000	2.22	4030	-23	8.1	470	1130	1570	2420
		15	7500	2.78	6330	-18	12.5	630	1560	2190	3430
		20	10000	3.34	8670	-16	16.8	750	1860	2600	4080
	45	10	7070	1.88	5850	-40	8.0	330	810	1120	1720
		15	10610	2.44	9050	-36	12.3	510	1270	1770	2730
		20	14140	2.86	12350	-34	16.5	630	1570	2190	3450
600	20	10	3420	2.18	2730	-14	7.5	570	1370	1900	2940
		15	5130	2.88	4290	-10	11.9	760	1870	2630	4130
		20	6840	3.58	5900	- 6	16.4	880	2190	3060	4800
	30	10	5000	2.08	3990	-24	7.5	430	1030	1430	2210
		15	7500	2.64	6270	-21	11.7	600	1490	2080	3250
		20	10000	3.34	8530	-18	16.0	730	1820	2550	4000
	45	10	7070	1.88	5740	-40	7.5	310	760	1050	1610
		15	10610	2.30	9000	-38	11.6	480	1180	1640	2510
		20	14140	2.86	12180	-35	15.7	600	1500	2090	3290

F4-34-VI-117-9

Figure 6-20 (Sheet 9 of 9) NEW

DIVE TOSS RIPPLE RELEASE

MK20 MOD 2 & MOD 3 (ROCKEYE II)

2.0 G PULLOUT
0.10 SEC RELEASE INTERVAL
FUZE FUNCTION TIME - 6.0 SEC

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER		WRCS C_B SETTING
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION ALTITUDE (FT)	TIME RELEASE TO IMPACT (SEC)	6 BOMB STICK (FT)	12 BOMB STICK (FT)	
450	20	4000	11700	5.7	2840	9	1590	13.3	490	1070	1.51
		4500	13160	6.8	3230	6	2170	16.3	480	1060	1.78
		5000	14620	8.0	3650	3	2810	19.5	470	1040	2.10
500	20	4000	11700	5.1	2770	11	1280	11.5	500	1120	1.43
		4500	13160	6.0	3130	9	1790	14.2	520	1140	1.67
		5000	14620	7.1	3500	7	2350	17.1	520	1130	1.96
		5500	16080	8.2	3900	5	2940	20.0	510	1120	2.28
550	20	4000	11700	4.7	2700	13	1000	10.0	520	1140	1.35
		4500	13160	5.4	3060	11	1480	12.5	540	1190	1.55
		5000	14620	6.3	3410	9	1970	15.0	560	1210	1.81
		5500	16080	7.3	3760	8	2500	17.7	550	1210	2.11
		6000	17540	8.3	4150	6	3060	20.4	540	1200	2.44
450	30	4500	9000	3.8	3140	23	840	8.5	380	840	1.21
		5000	10000	4.3	3490	22	1270	10.2	420	910	1.30
		5500	11000	4.8	3840	20	1700	12.0	440	970	1.44
		6000	12000	5.4	4170	19	2130	14.0	460	1010	1.60
		6500	13000	6.0	4520	18	2570	16.0	470	1030	1.80
		7000	14000	6.7	4850	16	3020	18.1	480	1150	2.02
500	30	5000	10000	3.9	3440	23	960	8.8	400	880	1.25
		5500	11000	4.4	3770	22	1360	10.4	430	960	1.36
		6000	12000	4.8	4140	21	1780	12.2	460	1010	1.50
		6500	13000	5.4	4440	20	2190	14.1	480	1060	1.67
		7000	14000	6.0	4760	19	2600	15.9	500	1090	1.87
		7500	15000	6.6	5090	17	3020	17.8	510	1110	2.08
550	30	5500	11000	4.0	3740	24	1060	9.1	420	920	1.29
		6000	12000	4.4	4080	23	1460	10.7	450	1000	1.41
		6500	13000	4.9	4400	22	1850	12.4	480	1060	1.55
		7000	14000	5.4	4720	21	1250	14.2	500	1110	1.73
		7500	15000	6.0	5010	20	2640	15.9	520	1140	1.93
		8000	16000	6.6	5310	19	3030	17.7	530	1170	2.14
450	45	7500	10610	3.8	5480	37	2160	12.0	380	840	1.45
		8000	11310	4.1	5830	36	2550	13.4	400	890	1.57
500	45	7500	10610	3.5	5420	39	1780	10.5	360	790	1.36
		8000	11310	3.8	5750	38	2140	11.7	390	850	1.46
550	45	7500	10610	3.3	5340	40	1390	9.1	330	730	1.29
		8000	11310	3.5	5710	39	1770	10.1	360	800	1.38

* MPI - Mean Point of Impact

4C-34-1-1-(203-1)

Figure 6-21 (Sheet 1 of 4)

DIVE TOSS RIPPLE RELEASE

MK20 MOD 2 & MOD 3 (ROCKEYE II)

2.0 G PULLOUT
0.10 SEC RELEASE INTERVAL
FUZE FUNCTION TIME - 7.0 SEC

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER		WRCS
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION ALTITUDE (FT)	TIME RELEASE TO IMPACT (SEC)	6 BOMB STICK (FT)	12 BOMB STICK (FT)	C_B SETTING
450	20	4000	11700	5.5	2860	9	1280	12.4	510	1110	1.35
		4500	13160	6.4	3260	7	1860	15.3	500	1100	1.55
		5000	14620	7.5	3680	4	2490	18.5	490	1070	1.81
		5500	16080	8.7	4130	2	3190	21.9	470	1030	2.10
500	20	4000	11700	4.9	2800	11	940	10.7	520	1150	1.30
		4500	13160	5.7	3170	10	1470	13.3	530	1170	1.47
		5000	14620	6.7	3540	8	2030	16.1	530	1160	1.70
		5500	16080	7.7	3940	6	2630	19.1	520	1150	1.96
		6000	17540	8.8	4370	3	3270	22.1	510	1120	2.26
550	20	4000	11700	4.5	2740	13	650	9.3	520	1150	1.26
		4500	13160	5.2	3100	12	1140	11.6	550	1200	1.39
		5000	14620	6.0	3460	10	1640	14.1	560	1230	1.58
		5500	16080	6.9	3820	8	2180	16.8	560	1230	1.82
		6000	17540	7.9	4190	6	2750	19.5	560	1220	2.09
		6500	19000	8.9	4600	5	3360	22.4	550	1210	2.39
450	30	5000	10000	4.2	3520	22	840	9.4	410	900	1.22
		5500	11000	4.6	3900	21	1290	11.1	440	970	1.30
		6000	12000	5.1	4260	20	1740	13.0	460	1010	1.42
		6500	13000	5.7	4600	18	2190	15.0	470	1043	1.57
		7000	14000	6.3	4950	17	2650	17.1	480	1060	1.74
		7500	15000	6.9	5310	16	3130	19.2	490	1180	1.93
500	30	5500	11000	4.2	3840	23	930	9.6	430	940	1.26
		6000	12000	4.6	4200	22	1360	11.3	460	1000	1.35
		6500	13000	5.1	4540	21	1780	13.1	480	1060	1.47
		7000	14000	5.6	4880	20	2220	15.0	500	1100	1.62
		7500	15000	6.2	5210	18	2650	16.9	510	1120	1.79
		8000	16000	6.8	5540	17	3090	18.8	520	1130	1.98
550	30	6000	12000	4.3	4120	23	1000	9.8	440	970	1.29
		6500	13000	4.7	4470	22	1410	11.4	470	1040	1.38
		7000	14000	5.1	4820	21	1830	13.2	500	1100	1.51
		7500	15000	5.6	5150	20	2240	14.9	520	1140	1.66
		8000	16000	6.2	5440	19	2650	16.7	530	1170	1.83
450	45	6500	9190	3.2	4780	39	790	8.6	320	700	1.19
		7000	9990	3.4	5180	38	1210	9.8	340	750	1.24
		7500	10610	3.7	5530	37	1600	11.0	370	820	1.30
		8000	11310	3.9	5930	37	2020	12.4	390	870	1.39
500	45	7000	9900	3.2	5090	39	780	8.5	320	770	1.21
		7500	10610	3.4	5480	36	1180	9.6	350	760	1.25
		8000	11310	3.6	5860	38	1580	10.8	370	820	1.32
600	45	8000	11310	3.4	5780	39	1150	9.4	350	760	1.27

* MPI - Mean Point of Impact

4C-34-1-1-(203-2)

Figure 6-21 (Sheet 2 of 4)

DIVE TOSS RIPPLE RELEASE

MK20 MOD 2 & MOD 3 (ROCKEYE II)

2.0 G PULLOUT
0.10 SEC RELEASE INTERVAL
FUZE FUNCTION TIME - 8.0 SEC

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER		WRCS C_B SETTING
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION ALTITUDE (FT)	TIME RELEASE TO IMPACT (SEC)	6 BOMB STICK (FT)	12 BOMB STICK (FT)	
450	20	4000	11700	5.3	2890	10	930	11.5	520	1140	1.25
		4500	13160	6.1	3300	8	1510	14.3	520	1140	1.39
		5000	14620	7.1	3700	5	2150	17.5	510	1110	1.59
		5500	16080	8.3	4140	3	2860	20.9	480	1060	1.84
500	20	4500	13160	5.5	3200	10	1120	12.3	550	1190	1.34
		5000	14620	6.3	3590	8	1680	15.1	550	1200	1.51
		5500	16080	7.3	3980	6	2280	18.0	540	1180	1.72
		6000	17540	8.4	4390	4	2940	21.2	520	1140	1.98
		6500	19000	9.5	4840	2	3640	24.3	510	1220	2.26
550	20	4500	13160	5.0	3140	12	770	10.7	560	1220	1.30
		5000	14620	5.7	3510	11	1280	13.1	570	1260	1.42
		5500	16080	6.5	3880	9	1820	15.7	570	1260	1.60
		6000	17540	7.4	4250	7	2400	18.5	570	1250	1.82
		6500	19000	8.4	4640	5	3010	21.3	560	1230	2.08
450	30	5500	11000	4.5	3930	21	840	10.4	440	960	1.23
		6000	12000	4.9	4310	20	1310	12.1	460	1010	1.30
		6500	13000	5.4	4670	19	1770	14.0	500	1050	1.41
		7000	14000	6.0	5020	18	2245	16.1	490	1080	1.54
		7500	15000	6.6	5380	16	2730	18.2	500	1090	1.70
		8000	16000	7.2	5740	15	3230	20.3	500	1100	1.87
500	30	6000	12000	4.5	4230	22	900	10.5	450	990	1.27
		6500	13000	4.9	4600	21	1340	12.1	480	1050	1.34
		7000	14000	5.4	4940	20	1780	13.9	500	1090	1.45
		7500	15000	5.9	5290	19	2230	15.8	510	1130	1.58
		8000	16000	6.5	5620	18	2680	17.8	520	1150	1.73
550	30	6500	13000	4.5	4540	23	950	10.6	460	1020	1.30
		7000	14000	4.9	4900	22	1370	12.2	490	1080	1.37
		7500	15000	5.4	5220	21	1740	13.9	510	1130	1.48
		8000	16000	5.8	5580	20	2230	15.7	530	1170	1.61
450	45	7500	10610	3.6	5580	38	1020	10.2	360	790	1.23
		8000	11310	3.8	5980	37	1440	11.4	380	850	1.28
500	45	8000	11310	3.5	5920	39	980	10.0	360	790	1.25

* MPI - Mean Point of Impact

4C-34-1-1-(203-3)

Figure 6-21 (Sheet 3 of 4)

DIVE TOSS RIPPLE RELEASE

MK20 MOD 2 & MOD 3 (ROCKEYE II)

4.0 G PULLOUT
0.10 AND 0.14 SECONDS
RELEASE INTERVAL

FUZE FUNCTION ALTITUDE – 2000 FT									
PICKLE CONDITIONS			FUZE FUNCTION TIME	MIDDLE BOMB OF EIGHT–BOMB RIPPLE					
					RELEASE				
TAS KTS	DIVE ANG DEG	ALT AGL FT	SEC	PICKLE TO RELEASE TIME SEC	ALT FT	ANG DEG	TIME RELEASE TO IMPACT SEC	EIGHT BOMB STICK LENGTH FT	C_B SETTING
				0.10 SEC RELEASE INTERVAL					
500	45	8000	8.0	2.40	6620	–36	13.3	1010	1.40
550	45	8000	7.3	2.30	6530	–37	12.4	960	1.41
				0.14 SEC RELEASE INTERVAL					
500	45	8000	8.0	2.52	6550	–35	13.3	1420	1.40
550	45	8000	7.2	2.38	6480	–37	12.4	1330	1.41

4C–34–1–1–(203–4)

Figure 6-21 (Sheet 4 of 4)

DIVE TOSS RIPPLE RELEASE

CBU-24B/B, -29B/B, -49B/B

2.0 G PULLOUT
0.06 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			WRCS C_B SETTING
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	
500	20	5130	15	6.38	3700	- 8	7.6	16.6	290	360	730	1.44
		6840	20	7.64	5271	- 6	12.4	20.0	350	430	860	1.24
550	20	5130	15	6.18	3550	-10	6.6	15.9	280	350	690	1.61
		6840	20	7.34	5090	- 8	11.2	19.1	340	430	850	1.34
600	20	5130	15	6.12	3390	-11	5.8	15.2	260	320	650	1.83
		6840	20	7.10	4920	- 9	10.2	18.4	330	410	830	1.46
500	30	5000	10	4.56	3210	-22	3.6	11.6	150	190	370	1.82
		7500	15	5.40	5440	-20	8.5	15.2	220	280	590	1.29
		10000	20	6.66	7560	-17	12.8	18.8	290	370	730	1.23
550	30	5000	10	4.50	3040	-23	3.0	11.0	130	170	330	2.12
		7500	15	5.22	5270	-21	7.7	14.5	230	280	560	1.39
		10000	20	6.42	7360	-19	11.8	17.9	280	350	710	1.31
600	30	7500	15	5.16	5090	-22	7.0	13.9	210	260	530	1.51
		10000	20	6.30	7150	-20	11.1	17.3	270	340	680	1.39
500	45	10610	15	4.26	8100	-37	9.5	14.3	200	250	510	1.21
		14140	20	5.28	11080	-34	13.7	18.2	250	320	630	1.23
550	45	10610	15	4.14	7920	-38	8.9	13.6	190	240	480	1.28
		14140	20	5.16	10840	-36	12.9	17.5	240	300	600	1.31
600	45	10610	15	4.08	7730	-38	8.3	13.1	180	230	450	1.35
		14140	20	5.04	10635	-36	12.3	16.8	230	290	570	1.37

* MPI - Mean Point of Impact

4C-34-1-1-(208-1)

Figure 6-21A (Sheet 1 of 9)

DIVE TOSS RIPPLE RELEASE

CBU-24B/B, -29B/B, -49B/B

2.0 G PULLOUT
0.10 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			WRCS C_B SETTING
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	
500	20	5130	15	6.40	3700	- 8	7.6	16.6	480	600	1210	1.44
		6840	20	7.70	5270	- 6	12.4	20.1	580	720	1440	1.24
550	20	5130	15	6.20	3540	-10	6.6	15.9	460	580	1150	1.62
		6840	20	7.30	5090	- 8	11.2	19.1	570	710	1430	1.34
600	20	5130	15	6.10	3390	-11	5.8	15.2	430	540	1080	1.84
		6840	20	7.10	4920	- 9	10.2	18.4	550	690	1380	1.46
500	30	5000	10	4.50	3230	-22	3.6	11.5	250	310	620	1.80
		7500	15	5.40	5440	-20	8.4	15.2	400	490	990	1.29
		10000	20	6.70	7560	-17	12.8	18.8	490	610	1220	1.23
550	30	5000	10	4.50	3040	-23	3.0	10.9	220	280	550	2.12
		7500	15	5.30	5240	-21	7.6	14.5	370	470	940	1.40
		10000	20	6.40	7370	-19	11.8	18.0	470	590	1180	1.31
600	30	7500	15	5.10	5110	-22	7.0	13.9	350	440	880	1.51
		10000	20	6.30	7150	-20	11.1	17.3	450	560	1130	1.39
500	45	10610	15	4.30	8080	-37	9.5	14.3	340	420	850	1.21
		14140	20	5.30	11070	-34	13.7	18.2	420	530	1050	1.23
550	45	10610	15	4.10	7940	-38	8.9	13.6	320	400	800	1.28
		14140	20	5.10	10870	-36	12.9	17.5	400	500	1000	1.31
600	45	10610	15	4.10	7710	-38	8.3	13.1	300	380	750	1.35
		14140	20	5.00	10660	-36	12.3	16.8	380	480	960	1.37

* MPI - Mean Point Of Impact

4C-34-1-1-(208-2)

Figure 6-21A (Sheet 2 of 9)

DIVE TOSS RIPPLE RELEASE

CBU-24B/B, -29B/B, -49B/B

2.0 G PULLOUT
0.14 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			WRCS C_B
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	SETTING
500	20	5130	15	6.44	3690	- 8	7.6	16.6	680	850	1700	1.44
		6840	20	7.70	5260	- 6	12.4	20.1	810	1010	2020	1.24
550	20	5130	15	6.16	3550	-10	6.6	15.8	640	810	1610	1.62
		6840	20	7.28	5090	- 8	11.2	19.1	790	1000	1990	1.34
600	20	5130	15	6.16	3370	-11	5.8	15.2	610	750	1520	1.84
		6840	20	7.14	4910	- 9	10.3	18.4	770	960	1930	1.46
500	30	5000	10	4.62	3190	-22	3.6	11.5	350	430	870	1.83
		7500	15	5.46	5420	-20	8.4	15.2	550	690	1380	1.29
		10000	20	6.72	7550	-17	12.8	18.8	680	850	1710	1.23
550	30	5000	10	4.48	3040	-23	3.0	10.9	310	380	770	2.12
		7500	15	5.32	5230	-21	7.6	14.5	520	650	1310	1.40
		10000	20	6.44	7350	-19	11.8	18.0	660	830	1650	1.31
600	30	7500	15	5.18	5073	-22	6.9	13.9	490	620	1230	1.51
		10000	20	6.30	7150	-20	11.1	17.3	630	790	1580	1.39
500	45	10610	15	4.34	8050	-37	9.5	14.3	470	590	1180	1.21
		14140	20	5.32	11060	-34	13.7	18.2	590	740	1470	1.23
550	45	10610	15	4.20	7880	-38	8.8	13.6	450	560	1110	1.29
		14140	20	5.18	10820	-36	12.9	17.4	560	700	1400	1.31
600	45	10610	15	4.06	7740	-38	8.3	13.1	420	520	1050	1.35
		14140	20	5.04	10630	-36	12.3	16.8	530	670	1330	1.37

* MPI - Mean Point of Impact

Figure 6-21A (Sheet 3 of 9)

4C-34-1-1-(208-3)

DIVE TOSS RIPPLE RELEASE

CBU-24B/B, -29B/B, -49B/B

3.0 G PULLOUT
0.06 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			WRCS C_B SETTING
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	
500	20	3420	10	3.96	2540	- 7	4.1	14.9	360	450	900	2.09
		5130	15	4.38	4210	- 6	10.0	18.5	490	610	1210	1.30
		6840	20	5.28	5870	- 2	15.4	22.8	540	680	1360	1.19
550	20	3420	10	4.02	2410	- 8	3.2	14.3	320	400	800	2.58
		5130	15	4.26	4090	- 7	8.9	12.7	470	590	1180	1.42
		6840	20	5.10	5730	- 4	14.1	21.6	550	690	1370	1.27
600	20	3420	10	4.14	2280	- 9	2.4	13.8	270	350	690	3.35
		5130	15	4.20	3980	- 9	8.1	17.1	460	570	1140	1.56
		6840	20	4.98	5590	- 6	13.1	20.8	540	680	1350	1.38
500	30	5000	10	3.18	3780	-21	5.1	12.8	270	340	670	1.53
		7500	15	3.84	6090	-18	10.3	16.8	390	490	980	1.23
		10000	20	4.68	8380	-14	15.2	21.0	470	590	1170	1.19
550	30	5000	10	3.12	3661	-22	4.5	12.2	250	310	620	1.69
		7500	15	3.72	5960	-19	9.4	16.1	370	470	930	1.32
		10000	20	4.56	8220	-16	14.2	20.1	460	570	1140	1.28
600	30	5000	10	3.12	3530	-22	3.9	11.7	240	290	570	1.90
		7500	15	3.66	5830	-20	8.7	15.4	360	450	890	1.42
		10000	20	4.44	8060	-17	13.3	19.3	440	550	1090	1.36
500	45	5300	7.5	2.28	3950	-39	3.5	9.0	170	210	420	1.45
		7070	10	2.52	5590	-38	6.1	11.2	230	280	570	1.25
		10610	15	3.12	8800	-35	10.8	15.5	330	410	820	1.19
		14140	20	3.78	12010	-32	15.4	19.9	400	500	1000	1.21
550	45	7070	10	2.46	5480	-39	5.5	10.6	210	270	530	1.33
		10610	15	3.06	8650	-36	10.1	14.8	310	390	770	1.26
		14140	20	3.72	11820	-34	14.6	19.1	380	480	960	1.29
600	45	7070	10	2.40	5370	-40	5.1	10.1	200	240	490	1.42
		10610	15	3.00	8510	-37	9.5	14.3	290	360	730	1.33
		14140	20	3.66	11640	-35	13.9	18.4	360	450	910	1.37

* MPI - Mean Point of Impact

4C-34-1-1-(208-4)

Figure 6-21A (Sheet 4 of 9)

DIVE TOSS RIPPLE RELEASE

CBU-24B/B, -29B/B, -49B/B

3.0 G PULLOUT
0.10 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			WRCS
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	C_B SETTING
500	20	3420	10	4.10	2520	- 7	4.1	15.0	610	770	1530	2.10
		5130	15	4.40	4200	- 6	10.0	18.5	810	1020	2020	1.30
		6840	20	5.30	5860	- 2	15.3	22.5	910	1130	2250	1.19
550	20	3420	10	4.10	2400	- 8	3.2	14.3	540	680	1350	2.61
		5130	15	4.30	4080	- 7	8.9	17.7	790	990	1980	1.42
		6840	20	5.10	5720	- 4	14.0	21.5	910	1140	2270	1.28
600	20	5130	15	4.20	3970	- 9	8.1	17.0	760	950	1890	1.57
		6840	20	5.00	5580	- 6	13.0	20.7	900	1130	2240	1.38
500	30	5000	10	3.20	3770	-20	5.1	12.9	450	570	1130	1.53
		7500	15	3.80	6100	-18	10.3	16.8	650	820	1630	1.23
		10000	20	4.70	8380	-14	15.2	21.0	780	980	1950	1.19
550	30	5000	10	3.10	3670	-22	4.5	12.1	410	520	1030	1.69
		7500	15	3.70	5970	-19	9.4	16.0	620	780	1550	1.32
		10000	20	4.50	8230	-16	14.1	20.0	760	950	1890	1.28
600	30	5000	10	3.10	3540	-22	3.9	11.7	380	480	950	1.90
		7500	15	3.70	5810	-20	8.7	15.5	590	740	1480	1.42
		10000	20	4.50	8040	-17	13.4	19.4	730	920	1830	1.36
500	45	5300	7.5	2.30	3940	-39	3.5	9.0	280	350	690	1.45
		7070	10	2.50	5600	-38	6.1	11.2	380	470	950	1.25
		10610	15	3.10	8810	-35	10.8	15.5	540	680	1360	1.19
		14140	20	3.80	12000	-32	15.4	19.9	670	840	1670	1.21
550	45	7070	10	2.50	5450	-39	5.5	10.6	350	440	880	1.33
		10610	15	3.10	8630	-36	10.1	14.8	510	640	1280	1.26
		14140	20	3.70	11830	-34	14.6	19.0	640	800	1590	1.29
600	45	7070	10	2.40	5370	-40	5.1	10.1	330	410	820	1.42
		10610	15	3.00	8510	-37	9.5	14.3	480	600	1210	1.33
		14140	20	3.70	11610	-35	13.9	18.4	610	760	1520	1.37

* MPI - Mean Point of Impact

4C-34-1-1-(208-5)

Figure 6-21A (Sheet 5 of 9)

DIVE TOSS RIPPLE RELEASE

CBU-24B/B, -29B/B, -49B/B

3.0 G PULLOUT
0.14 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			WRCS C_B SETTING
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	
500	20	3420	10	4.06	2520	- 7	4.1	15.0	850	1080	2130	2.10
		5130	15	4.48	4190	- 5	10.0	18.6	1140	1440	2850	1.30
		6840	20	5.32	5860	- 2	15.3	22.6	1260	1580	3150	1.19
550	20	3420	10	4.06	2400	- 8	3.2	14.3	740	940	1870	2.62
		5130	15	4.34	4080	- 7	9.0	17.8	1110	1400	2780	1.42
		6840	20	5.18	5710	- 4	14.1	21.6	1280	1610	3191	1.28
600	20	5130	15	4.20	3970	- 9	8.1	17.0	1060	1330	2640	1.57
		6840	20	5.04	5570	- 6	13.1	20.8	1250	1580	3140	1.38
500	30	5000	10	3.22	3760	-20	5.1	12.8	620	790	1570	1.53
		7500	15	3.92	6060	-17	10.3	16.9	920	1150	2290	1.23
		10000	20	4.76	8360	-14	15.2	21.1	1040	1370	2730	1.19
550	30	5000	10	3.22	3620	-21	4.4	12.2	580	730	1450	1.70
		7500	15	3.78	5940	-19	9.4	16.1	870	1100	2180	1.32
		10000	20	4.62	8190	-16	14.2	20.1	1070	1340	2660	1.28
600	30	5000	10	3.08	3540	-23	3.9	11.6	530	660	1320	1.91
		7500	15	3.64	5830	-20	8.7	15.4	820	1030	2060	1.42
		10000	20	4.48	8040	-17	13.3	19.3	1020	1280	2550	1.36
500	45	5300	7.5	2.24	3970	-39	3.6	9.0	390	480	940	1.46
		7070	10	2.52	5590	-38	6.0	11.2	530	660	1320	1.25
		10610	15	3.08	8820	-37	10.8	15.5	760	950	1900	1.19
		14140	20	3.78	12000	-33	15.4	19.8	930	1170	2110	1.21
550	45	7070	10	2.52	5440	-39	5.5	10.6	490	620	1220	1.34
		10610	15	3.08	8640	-36	10.1	14.8	720	900	1790	1.26
		14140	20	3.78	11780	-34	14.6	19.1	890	1120	2230	1.29
600	45	7070	10	2.38	5380	-40	5.1	10.1	460	570	1130	1.43
		10610	15	3.08	8460	-37	9.5	14.2	680	850	1690	1.34
		14140	20	3.64	11650	-35	13.9	18.4	850	1060	2120	1.37

* MPI - Mean Point of Impact

4C-34-1-1-(208-6)

Figure 6-21A (Sheet 6 of 9)

CBU-24B/B, -29B/B, -49B/B

4.0 G PULLOUT
0.06 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			WRCS C_B SETTING
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	
500	20	3420	10	3.12	2730	- 7	5.1	15.6	530	670	1320	1.82
		5130	15	3.48	4410	- 4	11.0	19.4	660	830	1650	1.26
		6840	20	4.26	6100	+ 1	17.0	24.0	720	900	1790	1.17
550	20	3420	10	3.12	2640	- 8	4.3	15.0	490	610	1220	2.14
		5130	15	3.42	4310	- 6	10.0	18.6	660	830	1650	1.36
		6840	20	4.02	5980	- 2	15.3	22.6	740	920	1840	1.25
600	20	3420	10	3.18	2540	- 8	3.6	14.5	450	560	1120	2.55
		5130	15	3.36	4220	- 7	9.2	17.9	640	810	1590	1.49
		6840	20	3.96	5870	- 4	14.4	21.9	730	910	1820	1.35
500	30	5000	10	2.64	3990	-20	5.8	13.4	390	480	960	1.45
		7500	15	3.12	6370	-16	11.2	17.6	540	680	1350	1.21
		10000	20	3.78	8590	- 6	16.5	22.2	630	790	1580	1.18
550	30	5000	10	2.58	3901	-21	5.1	12.8	360	450	890	1.59
		7500	15	3.00	6270	-18	10.2	16.8	510	650	1290	1.29
		10000	20	3.66	8590	-14	15.3	21.2	620	780	1560	1.26
600	30	5000	10	2.52	3820	-22	4.6	12.2	330	410	820	1.75
		7500	15	3.00	6140	-19	9.6	16.2	490	620	1230	1.39
		10000	20	3.60	8460	-16	14.5	20.4	600	750	1500	1.35
500	45	5300	7.5	1.92	4170	-39	3.9	9.3	230	290	560	1.40
		7070	10	2.16	5810	-37	6.5	11.6	320	400	780	1.24
		10610	15	2.58	9130	-35	11.4	16.1	450	560	1120	1.18
		14140	20	3.12	12410	-31	16.3	20.7	550	680	1370	1.20
550	45	5300	7.5	1.92	4060	-40	3.5	8.8	210	260	510	1.51
		7070	10	2.10	5720	-38	5.9	11.0	300	370	720	1.31
		10610	15	2.52	9010	-36	10.7	15.4	420	530	1060	1.25
		14140	20	3.06	12250	-33	15.4	19.9	520	650	1310	1.28
600	45	7070	10	2.04	5630	-39	5.5	10.5	270	340	670	1.39
		10610	15	2.52	8860	-37	10.1	14.8	400	500	1000	1.33
		14140	20	3.00	12110	-34	14.7	19.2	500	620	1240	1.36

* MPI - Mean Point of Impact

4C-34-1-1-(208-7)

Figure 6-21A (Sheet 7 of 9)

CBU-24B/B, -29B/B, -49B/B

4.0 G PULLOUT
0.10 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			WRCS C_B SETTING
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	
500	20	3420	10	3.10	2730	- 7	5.1	15.5	870	1110	2180	1.82
		5130	15	3.50	4410	- 4	11.1	19.4	1110	1390	2770	1.26
		6840	20	4.20	6100	0	16.8	23.8	1190	1490	2970	1.17
550	20	3420	10	3.10	2640	- 8	4.2	14.9	800	1020	2020	2.14
		5130	15	3.40	4310	- 6	10.0	18.6	1090	1380	2730	1.37
		6840	20	4.00	5980	- 3	15.3	22.6	1220	1540	3080	1.25
600	20	3420	10	3.20	2530	- 8	3.6	14.5	750	950	1880	2.55
		5130	15	3.30	4230	- 8	9.0	17.8	1040	1320	2600	1.50
		6840	20	4.00	5870	- 4	14.4	22.0	1220	1540	3050	1.35
500	30	5000	10	2.60	4000	-20	5.7	13.3	640	800	1590	1.45
		7500	15	3.20	6340	-16	11.2	17.7	910	1140	2260	1.21
		10000	20	3.80	8720	-12	16.4	22.2	1050	1320	2630	1.18
550	30	5000	10	2.60	3890	-21	5.1	12.7	590	750	1490	1.59
		7500	15	3.00	6260	-18	10.2	16.7	860	1080	2140	1.29
		10000	20	3.70	8580	-14	15.3	21.2	1040	1300	2590	1.26
600	30	5000	10	2.60	3780	-22	4.6	12.2	550	690	1380	1.76
		7500	15	3.00	6140	-19	9.5	16.2	820	1030	2040	1.39
		10000	20	3.60	8450	-16	14.4	20.3	1000	1250	2490	1.35
500	45	5300	7.5	1.90	4180	-39	3.9	9.3	370	470	900	1.40
		7070	10	2.10	5840	-38	6.5	11.6	520	650	1270	1.23
		10610	15	2.60	9120	-35	11.4	16.1	750	940	1860	1.18
		14140	20	3.10	12420	-31	16.3	20.7	910	1140	2270	1.20
550	45	5300	7.5	1.90	4070	-40	3.5	8.8	340	430	830	1.50
		7070	10	2.10	5720	-38	5.9	11.0	490	610	1180	1.31
		10610	15	2.50	9020	-36	10.7	15.4	700	880	1760	1.25
		14140	20	3.00	12280	-33	15.4	19.8	870	1090	2170	1.28
600	45	7070	10	2.10	5590	-39	5.5	10.5	450	570	1100	1.40
		10610	15	2.50	8870	-37	10.1	14.8	660	830	1660	1.33
		14140	20	3.00	12110	-34	14.7	19.2	830	1040	2070	1.36

* MPI - Mean Point of Impact

4C-34-1-1-(208-8)

Figure 6-21A (Sheet 8 of 9)

DIVE TOSS RIPPLE RELEASE

CBU-24B/B, -29B/B, -49B/B

4.0 G PULLOUT
0.14 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			WRCS C_B SETTING
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	
500	20	3420	10	3.22	2710	- 6	5.2	15.7	1260	1610	3180	1.83
		5130	15	3.50	4400	- 4	11.0	19.4	1540	1950	3840	1.26
		6840	20	4.20	6090	0	16.7	23.7	1650	2080	4140	1.17
550	20	3420	10	3.22	2620	- 7	4.3	15.1	1160	1490	2950	2.15
		5130	15	3.36	4310	- 7	9.8	18.4	1510	1910	3770	1.37
		6840	20	4.06	5970	- 2	15.3	22.6	1710	2160	4280	1.25
600	20	3420	10	3.22	2520	- 8	3.6	14.5	1040	1330	2640	2.57
		5130	15	3.36	4210	- 8	9.1	17.9	1470	1860	3670	1.50
		6840	20	3.92	5860	- 5	14.2	21.7	1680	2120	4200	1.36
500	30	5000	10	2.66	3980	-20	5.8	13.4	890	1130	2250	1.45
		7500	15	3.08	6370	-17	11.1	17.5	1240	1570	3170	1.21
		10000	20	3.78	8720	-12	16.4	22.1	1470	1850	3670	1.18
550	30	5000	10	2.52	3920	-21	5.1	12.6	820	1040	2050	1.59
		7500	15	3.08	6240	-18	10.3	16.8	1210	1520	3020	1.29
		10000	20	3.64	8590	-15	15.2	21.1	1440	1810	3590	1.26
600	30	5000	10	2.52	3810	-22	4.6	12.2	760	960	1900	1.76
		7500	15	2.94	6160	-20	9.5	16.1	1130	1430	2840	1.39
		10000	20	3.64	8440	-16	14.4	20.4	1400	1760	3490	1.35
500	45	5300	7.5	1.96	4150	-39	3.9	9.3	520	650	1240	1.41
		7070	10	2.10	5840	-38	6.5	11.6	720	910	1730	1.23
		10610	15	2.66	9090	-34	11.4	16.2	1040	1310	2610	1.18
		14140	20	3.08	12420	-31	16.2	20.6	1270	1590	3170	1.20
550	45	5300	7.5	1.96	4030	-39	3.4	8.8	470	600	1140	1.51
		7070	10	2.10	5720	-39	5.9	11.0	670	840	1610	1.31
		10610	15	2.52	9010	-36	10.7	15.4	980	1230	2440	1.25
		14140	20	3.08	12240	-33	15.4	19.9	1220	1530	3040	1.28
600	45	7070	10	2.10	5590	-39	5.4	10.5	620	790	1500	1.40
		10610	15	2.52	8860	-37	10.1	14.8	930	1160	2300	1.33
		14140	20	3.08	12060	-34	14.7	19.2	1160	1450	2900	1.36

* MPI - Mean Point of Impact

4C-34-1-1-(208-9)

Figure 6-21A (Sheet 9 of 9)

DIVE TOSS RIPPLE RELEASE

CBU-52A/B

2.0 G PULLOUT
0.06 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			WRCS C_B SETTING
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	
500	20	5130	15	6.32	3705	- 9	7.6	16.0	290	360	730	1.39
		6840	20	7.64	5270	- 6	12.4	19.5	350	430	860	1.22
550	20	5130	15	6.08	3560	-10	6.6	15.2	280	350	690	1.55
		6840	20	7.28	5090	- 8	11.2	18.6	340	430	850	1.32
600	20	5130	15	5.96	3410	-11	5.8	14.6	260	330	650	1.74
		6840	20	7.10	4920	- 9	10.3	17.8	330	410	830	1.43
500	30	5000	10	4.38	3270	-22	3.7	11.0	150	190	380	1.65
		7500	15	5.34	5460	-20	8.5	14.7	240	300	600	1.26
		10000	20	6.66	7560	-17	12.8	18.3	290	370	730	1.22
550	30	5000	10	4.32	3110	-23	3.1	10.4	140	170	350	1.88
		7500	15	5.16	5300	-21	7.7	14.0	200	280	570	1.35
		10000	20	6.42	7360	-19	11.9	17.5	280	350	710	1.30
600	30	7500	15	5.04	5130	-22	7.0	13.4	210	260	530	1.46
		10000	20	6.30	7150	-20	11.1	16.8	270	340	680	1.38
500	45	10610	15	4.26	8100	-37	9.6	13.9	200	260	510	1.20
		14140	20	5.28	11080	-34	13.8	17.9	250	320	630	1.23
550	45	10610	15	4.14	7920	-38	8.9	13.3	190	240	480	1.27
		14140	20	5.16	10840	-36	13.0	17.2	240	300	600	1.31
600	45	10610	15	4.08	7730	-38	8.3	12.7	180	230	440	1.34
		14140	20	5.04	10640	-36	12.3	16.5	230	290	570	1.38

*MPI - Mean Point of Impact

4C-34-1-1-(207-1)

Figure 6-21B (Sheet 1 of 9)

DIVE TOSS RIPPLE RELEASE

CBU-52A/B

2.0 G PULLOUT
0.10 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			WRCS C_B SETTING
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	
500	20	5130	15	6.30	3710	- 9	7.6	16.0	480	600	1210	1.39
		6840	20	7.60	5270	- 6	12.4	19.5	570	720	1440	1.22
550	20	5130	15	6.10	3560	-10	6.6	15.3	460	580	1150	1.55
		6840	20	7.30	5090	- 8	11.2	18.6	570	710	1420	1.32
600	20	5130	15	6.00	3400	-11	5.8	14.6	430	540	980	1.74
		6840	20	7.10	4920	- 9	10.3	17.8	550	690	1380	1.43
500	30	5000	10	4.40	3260	-22	3.7	11.0	260	320	640	1.66
		7500	15	5.40	5440	-20	8.5	14.7	400	500	1000	1.26
		10000	20	6.60	7590	-18	12.8	18.3	490	610	1220	1.22
550	30	5000	10	4.30	3120	-23	3.1	10.4	230	290	580	1.88
		7500	15	5.20	5280	-21	7.7	13.9	380	470	940	1.36
		10000	20	6.40	7370	-19	11.9	17.5	470	590	1180	1.30
600	30	7500	15	5.10	5110	-22	7.0	13.4	350	440	890	1.46
		10000	20	6.30	7154	-20	11.1	16.8	450	570	1130	1.38
500	45	10610	15	4.30	8080	-37	9.5	13.9	340	420	850	1.20
		14140	20	5.30	11070	-34	13.8	17.9	420	530	1060	1.23
550	45	10610	15	4.10	7940	-38	8.9	13.3	320	400	800	1.27
		14140	20	5.10	10870	-36	13.0	17.2	400	500	1000	1.31
600	45	10610	15	4.00	7780	-39	8.4	12.8	300	380	760	1.34
		14140	20	5.10	10600	-36	12.3	16.5	380	480	960	1.38

*MPI - Mean Point of Impact

Figure 6-21B (Sheet 2 of 9)

4C-34-1-1-(207-2)

DIVE TOSS RIPPLE RELEASE

CBU-52A/B

2.0 G PULLOUT
0.14 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			WRCS
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	C_E SETTING
500	20	5130	15	6.30	3710	- 9	7.6	16.0	680	850	1690	1.39
		6840	20	7.56	5280	- 6	12.4	19.4	800	1010	2010	1.22
550	20	5130	15	6.16	3550	-10	6.6	15.3	650	810	1620	1.55
		6840	20	7.28	5090	- 8	11.2	18.5	790	1000	1990	1.32
600	20	5130	15	6.02	3400	-11	5.8	14.6	610	760	1520	1.74
		6840	20	7.28	4890	- 9	10.3	17.9	780	970	1950	1.43
500	30	5000	10	4.48	3230	-22	3.6	11.0	360	450	890	1.67
		7500	15	5.32	5460	-20	8.5	14.6	550	690	1390	1.26
		10000	20	6.72	7550	-17	12.8	18.4	690	850	1710	1.22
550	30	5000	10	4.34	3100	-23	3.1	10.4	320	400	800	1.89
		7500	15	5.18	5280	-21	7.7	13.9	530	660	1320	1.36
		10000	20	6.44	7350	-19	11.9	17.5	660	820	1650	1.30
600	30	7500	15	5.04	5130	-22	7.0	13.4	500	620	1240	1.45
		10000	20	6.30	7150	-20	11.1	16.8	630	790	1580	1.38
500	45	10610	15	4.20	8130	-37	9.6	13.9	480	590	1190	1.20
		14140	20	5.32	11060	-34	13.7	17.9	590	740	1480	1.23
550	45	10610	15	4.20	7880	-38	8.8	13.2	450	560	1120	1.27
		14140	20	5.18	10820	-36	12.9	17.1	560	700	1400	1.31
600	45	10610	15	4.06	7740	-38	8.3	12.7	420	530	1060	1.34
		14140	20	5.04	10630	-36	12.3	16.5	540	670	1340	1.38

*MPI - Mean Point of Impact

Figure 6-21B (Sheet 3 of 9)

4C-34-1-1-(207-3)

DIVE TOSS RIPPLE RELEASE

CBU-52A/B

3.0 G PULLOUT
0.06 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	WRCS C_B SETTING
500	20	3420	10	3.90	2540	-8	4.0	14.3	360	450	880	1.97
		5130	15	4.38	4200	-6	9.9	17.9	480	610	1210	1.28
		6840	20	5.34	5860	-2	15.4	22.1	540	680	1350	1.18
550	20	3420	10	3.96	2420	-9	3.2	13.7	320	400	790	2.40
		5130	15	4.26	4090	-7	8.9	17.1	470	590	1180	1.39
		6840	20	5.10	5720	-4	14.0	21.0	540	680	1360	1.27
600	20	3420	10	4.02	2290	-9	2.4	13.2	270	340	680	3.02
		5130	15	4.14	3980	-9	8.0	16.4	460	570	1130	1.52
		6840	20	4.98	5580	-6	13.0	20.2	540	670	1340	1.37
500	30	5000	10	3.12	3790	-21	5.1	12.2	270	340	680	1.44
		7500	15	3.84	6090	-18	10.3	16.3	390	490	980	1.21
		10000	20	4.68	8380	-14	15.2	20.6	470	590	1170	1.19
550	30	5000	10	3.06	3680	-22	4.5	11.6	250	320	630	1.58
		7500	15	3.72	5960	-19	9.4	15.6	380	470	940	1.30
		10000	20	4.50	8230	-16	14.2	19.6	450	570	1140	1.27
600	30	5000	10	3.00	3580	-23	4.0	11.1	230	290	570	1.76
		7500	15	3.60	5850	-21	8.7	14.9	360	450	890	1.39
		10000	20	4.44	8060	-17	13.4	18.9	440	550	1090	1.36
500	45	5300	7.5	2.22	3990	-39	3.6	8.6	170	210	430	1.37
		7070	10	2.52	5590	-38	6.1	10.8	230	290	570	1.22
		10610	15	3.12	8800	-35	10.8	15.2	300	410	820	1.18
		14140	20	3.78	12010	-32	15.5	19.5	400	500	1010	1.21
550	45	7070	10	2.40	5510	-39	5.6	10.2	220	270	540	1.29
		10610	15	3.06	8650	-36	10.1	14.5	210	390	770	1.25
		14140	20	3.72	11290	-30	14.6	18.8	380	480	960	1.29
600	45	7070	10	2.40	5370	-40	5.1	9.7	200	250	500	1.37
		10610	15	3.00	8510	-37	9.6	13.9	290	370	730	1.33
		14140	20	3.66	11640	-35	14.0	18.1	370	460	910	1.37

* MPI - Mean Point of Impact

4C-34-1-1-(207-4)

Figure 6-21B (Sheet 4 of 9)

CBU-52A/B

3.0 G PULLOUT
0.10 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	WRCS C_B SETTING
500	20	3420	10	3.90	2540	- 8	4.0	14.3	590	750	1470	1.97
		5130	15	4.40	4200	- 6	9.8	17.8	800	990	2000	1.28
		6840	20	5.30	5860	- 2	15.3	22.0	900	1130	2240	1.18
550	20	3420	10	3.90	2430	- 9	3.2	13.6	520	660	1310	2.39
		5130	15	4.20	4100	- 8	8.8	17.0	780	980	1950	1.39
		6840	20	5.10	5720	- 4	14.0	21.0	910	1140	2270	1.27
600	20	3420	10	4.00	2300	- 9	2.4	13.1	450	570	1130	3.02
		5130	15	4.20	3970	- 9	8.1	16.5	760	960	1900	1.52
		6840	20	5.00	5580	- 6	13.0	20.2	890	1120	2230	1.37
500	30	5000	10	3.10	3800	-21	5.1	12.2	460	570	1140	1.44
		7500	15	3.80	6100	-18	10.3	16.3	650	820	1630	1.21
		10000	20	4.70	3830	-14	15.3	20.6	780	980	1950	1.19
550	30	5000	10	3.10	3670	-22	4.5	11.6	420	530	1060	1.59
		7500	15	3.70	5970	-19	9.4	15.5	630	780	1560	1.30
		10000	20	4.50	8230	-16	14.2	19.6	760	950	1890	1.27
600	30	5000	10	3.00	3580	-23	4.0	11.1	390	490	970	1.76
		7500	15	3.60	5850	-21	8.7	14.9	590	740	1480	1.39
		10000	20	4.40	8080	-18	13.3	18.9	730	910	1820	1.36
500	45	5300	7.5	2.20	4000	-40	3.6	8.6	280	360	700	1.37
		7070	10	2.50	5600	-38	6.1	10.8	390	480	980	1.22
		10610	15	3.10	8810	-35	10.8	15.2	540	680	1360	1.18
		14140	20	3.80	12000	-32	15.5	19.5	670	840	1670	1.21
550	45	7070	10	2.40	5510	-39	5.6	10.2	360	450	890	1.29
		10610	15	3.10	8630	-36	10.1	14.5	520	640	1290	1.25
		14140	20	3.70	11830	-34	14.6	18.7	640	800	1590	1.29
600	45	7070	10	2.40	5370	-40	5.1	9.7	330	410	830	1.37
		10610	15	3.00	8510	-37	9.5	13.9	490	610	1210	1.33
		14140	20	3.70	11610	-35	14.0	18.1	610	760	1520	1.37

* MPI - Mean Point of Impact

4C-2-34-1-1-(207-5)

Figure 6-21B (Sheet 5 of 9)

DIVE TOSS RIPPLE RELEASE

CBU-52A/B

3.0 G PULLOUT
0.14 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			WRCS C_B SETTING
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	
500	20	3420	10	3.92	2540	- 8	4.0	14.3	820	1050	2070	1.97
		5130	15	4.34	4200	- 6	9.9	17.8	1120	1410	2800	1.28
		6840	20	5.32	5860	- 2	15.3	22.0	1260	1580	3140	1.18
550	20	3420	10	3.92	2420	- 9	3.2	13.6	730	930	1840	2.39
		5130	15	4.20	4090	- 8	8.8	17.0	1090	1380	2730	1.39
		6840	20	5.04	5720	- 4	13.9	20.9	1260	1580	3180	1.27
600	20	3420	10	4.06	2280	- 9	2.4	13.2	630	800	1600	3.03
		5130	15	4.20	3970	- 9	8.1	16.5	1060	1340	2650	1.52
		6840	20	4.90	5590	- 6	12.9	20.0	1240	1550	3130	1.37
500	30	5000	10	3.08	3800	-21	5.1	12.1	630	800	1580	1.44
		7500	15	3.78	6100	-18	10.2	16.2	910	1140	2280	1.21
		10000	20	4.76	8360	-14	15.3	20.6	1100	1370	2730	1.19
550	30	5000	10	3.08	3670	-22	4.5	11.6	590	740	1470	1.59
		7500	15	3.78	5940	-19	9.4	15.6	880	1100	2200	1.30
		10000	20	4.48	8230	-16	14.1	19.5	1050	1320	2630	1.27
600	30	5000	10	3.08	3540	-23	3.9	11.1	540	680	1360	1.77
		7500	15	3.64	5830	-20	8.7	14.9	830	1040	2070	1.39
		10000	20	4.48	8040	-17	13.4	18.9	1020	1280	2550	1.36
500	45	5300	7.5	2.24	3970	-39	3.6	8.6	390	490	950	1.37
		7070	10	2.52	5590	-38	6.0	10.8	530	670	1330	1.22
		10610	15	3.08	8820	-36	10.8	15.1	760	950	1990	1.18
		14140	20	3.78	12000	-33	15.4	19.5	930	1170	2350	1.21
550	45	7070	10	2.38	5520	-39	5.6	10.2	500	620	1220	1.29
		10610	15	3.08	8640	-36	10.1	14.5	720	900	1800	1.25
		14140	20	3.78	11780	-34	14.6	18.7	890	1120	2230	1.30
600	45	7070	10	2.38	5380	-40	5.1	9.7	460	580	1140	1.37
		10610	15	3.08	8460	-37	9.5	13.9	680	850	1700	1.33
		14140	20	3.64	11650	-35	13.9	18.1	850	1060	2120	1.37

* MPI - Mean Point of Impact

4C-34-1-1-(207-6)

Figure 6-21B (Sheet 6 of 9)

DIVE TOSS RIPPLE RELEASE

CBU-52A/B

4.0 G PULLOUT
0.06 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			WRCS C_B SETTING
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	
500	20	3420	10	3.06	2730	- 7	5.0	14.9	520	650	1300	1.73
		5130	15	3.48	4410	- 4	11.0	18.8	660	830	1650	1.24
		6840	20	4.20	6100	+ 1	16.8	23.3	710	890	1780	1.16
550	20	3420	10	3.06	2640	- 8	4.2	14.3	480	610	1210	2.00
		5130	15	3.36	4320	- 6	9.9	17.9	650	820	1630	1.34
		6840	20	4.02	5980	- 2	15.4	22.1	730	920	1830	1.25
600	20	3420	10	3.06	2560	- 9	3.5	13.8	430	550	1090	2.36
		5130	15	3.30	4230	- 8	9.1	17.3	630	790	1570	1.46
		6840	20	3.96	5870	- 4	14.4	21.3	730	910	1810	1.35
500	30	5000	10	2.58	4010	-20	5.7	12.7	390	480	960	1.38
		7500	15	3.12	6360	-17	11.1	17.1	540	680	1350	1.19
		10000	20	3.78	8720	-12	16.4	21.7	630	790	1570	1.17
550	30	5000	10	2.52	3920	-21	5.1	12.1	360	450	900	1.50
		7500	15	3.00	6260	-18	10.2	16.2	520	650	1290	1.27
		10000	20	3.66	8590	-15	15.3	20.7	620	780	1550	1.26
600	30	5000	10	2.52	3810	-22	4.6	11.6	330	420	840	1.65
		7500	15	3.00	6140	-19	9.6	15.7	490	620	1230	1.37
		10000	20	3.60	8450	-16	14.4	19.9	600	750	1490	1.35
500	45	5300	7.5	1.92	4170	-39	3.9	8.9	230	290	560	1.34
		7070	10	2.10	5840	-38	6.5	11.2	320	400	780	1.20
		10610	15	2.58	9130	-35	11.4	15.8	450	560	1120	1.17
		14140	20	3.12	12410	-31	16.3	20.4	550	680	1370	1.20
550	45	5300	7.5	1.86	4090	-40	3.5	8.4	210	260	510	1.42
		7070	10	2.04	5750	-39	6.0	10.6	300	370	720	1.27
		10610	15	2.52	9010	-36	10.7	15.1	420	530	1060	1.24
		14140	20	3.06	12250	-33	15.5	19.6	520	650	1310	1.28
600	45	7070	10	2.04	5630	-39	5.5	10.1	270	340	670	1.35
		10610	15	2.52	8860	-37	10.1	14.5	400	500	1000	1.32
		14140	20	3.00	12110	-34	14.8	18.9	500	620	1240	1.37

*MPI - Mean Point of Impact

4C-34-1-1-(207-7)

Figure 6-21B (Sheet 7 of 9)

DIVE TOSS RIPPLE RELEASE

CBU-52A/B

4.0 G PULLOUT
0.10 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			WRCS
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	C_B SETTING
500	20	3420	10	3.10	2730	- 7	5.1	15.0	870	1110	2190	1.73
		5130	15	3.50	4410	- 4	11.1	18.9	1110	1390	2770	1.24
		6840	20	4.20	6100	+ 1	16.8	23.3	1180	1480	2950	1.16
550	20	3420	10	3.10	2640	- 8	4.2	14.4	810	1030	2040	2.00
		5130	15	3.40	4310	- 6	10.0	18.0	1090	1380	2730	1.34
		6840	20	4.00	5980	- 3	15.3	22.1	1220	1530	3060	1.25
600	20	3420	10	3.10	2550	- 9	3.5	13.9	730	930	1830	2.37
		5130	15	3.30	4230	- 8	9.1	17.3	1040	1320	2600	1.46
		6840	20	3.90	5880	- 5	14.2	21.2	1200	1510	3030	1.35
500	30	5000	10	2.60	4000	-20	5.8	12.8	650	810	1620	1.38
		7500	15	3.10	6370	-17	11.2	17.1	900	1130	2250	1.19
		10000	20	3.80	8720	-12	16.5	21.8	1050	1320	2630	1.17
550	30	5000	10	2.50	3930	-21	5.1	12.1	600	750	1500	1.50
		7500	15	3.00	6270	-18	10.2	16.3	860	1080	2150	1.27
		10000	20	3.60	8610	-15	15.2	20.6	1030	1290	2590	1.26
600	30	5000	10	2.50	3820	-22	4.6	11.6	560	700	1400	1.65
		7500	15	3.00	6140	-19	9.6	15.7	830	1040	2060	1.37
		10000	20	3.60	8460	-16	14.5	19.9	1000	1250	2490	1.35
500	45	5300	7.5	1.90	4180	-39	3.9	8.9	380	480	910	1.33
		7070	10	2.10	5840	-38	6.5	11.2	530	660	1280	1.20
		10610	15	2.60	9120	-35	11.4	15.8	750	940	1870	1.17
		14140	20	3.10	12420	-31	16.3	20.4	910	1140	2270	1.20
550	45	5300	7.5	1.90	4070	-40	3.5	8.4	350	440	840	1.42
		7070	10	2.10	5720	-38	5.9	10.6	490	620	1190	1.28
		10610	15	2.50	9020	-36	10.7	15.0	700	880	1760	1.24
		14140	20	3.00	12280	-33	15.4	19.5	870	1090	2170	1.28
600	45	7070	10	2.00	5660	-40	5.5	10.1	450	560	1090	1.35
		10610	15	2.50	8870	-37	10.1	14.5	670	830	1660	1.32
		14140	20	3.00	12110	-34	14.8	18.9	830	1030	2070	1.37

* MPI - Mean Point of Impact

4C-34-1-1-(207-8)

Figure 6-21B (Sheet 8 of 9)

CBU-52A/B

4.0 G PULLOUT
0.14 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			WRCS C_B SETTING
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	
500	20	3420	10	3.08	2730	- 7	5.0	14.9	1200	1540	3040	1.74
		5130	15	3.50	4400	- 4	11.0	18.8	1540	1940	3840	1.24
		6840	20	4.20	6090	0	16.7	23.2	1660	2070	4120	1.16
550	20	3420	10	3.08	2640	- 8	4.2	14.3	1120	1440	2830	2.02
		5130	15	3.36	4310	- 7	9.8	17.8	1510	1910	3770	1.34
		6840	20	4.06	5970	- 2	15.3	22.1	1710	2150	4260	1.25
600	20	3420	10	3.08	2550	- 9	3.5	13.8	1000	1280	2550	2.38
		5130	15	3.36	4210	- 8	9.1	17.3	1470	1860	3670	1.46
		6840	20	3.92	5860	- 5	14.2	21.1	1670	2110	4180	1.35
500	30	5000	10	2.52	4030	-20	5.7	12.7	890	1120	2230	1.38
		7500	15	3.08	6370	-17	11.1	17.0	1250	1580	3130	1.19
		10000	20	3.78	8720	-12	16.4	21.7	1470	1850	3670	1.17
550	30	5000	10	2.52	3920	-21	5.1	12.1	840	1060	2090	1.50
		7500	15	3.08	6240	-18	10.3	16.4	1210	1530	3040	1.28
		10000	20	3.64	8590	-15	15.3	20.6	1440	1810	3600	1.26
600	30	5000	10	2.52	3810	-22	4.6	11.6	780	980	1940	1.65
		7500	15	2.94	6160	-20	9.5	15.6	1140	1440	2860	1.37
		10000	20	3.64	8440	-16	14.5	20.0	1400	1760	3490	1.35
500	45	5300	7.5	1.96	4150	-39	3.9	8.9	530	670	1260	1.34
		7070	10	2.10	5840	-38	6.5	11.2	720	910	1740	1.20
		10610	15	2.66	9090	-34	11.5	15.8	1050	1320	2620	1.17
		14140	20	3.08	12420	-31	16.3	20.3	1270	1590	3200	1.20
550	45	5300	7.5	1.82	4120	-40	3.5	8.4	460	590	1120	1.42
		7070	10	2.10	5720	-39	5.9	10.6	680	850	1630	1.28
		10610	15	2.52	9010	-36	10.7	15.0	980	1240	2440	1.24
		14140	20	3.08	12240	-33	15.5	19.6	1220	1530	3040	1.28
600	45	7070	10	2.10	5590	-39	5.5	10.1	630	790	1520	1.36
		10610	15	2.52	8860	-37	10.1	14.5	930	1170	2310	1.32
		14140	20	3.08	12060	-34	14.8	18.9	1160	1450	2900	1.37

* MPI - Mean Point of Impact

4C-34-1-1-(207-9)

Figure 6-21B (Sheet 9 of 9)

DIVE TOSS RIPPLE RELEASE F-4E

CBU-52B/B DISPENSER AND BOMB

2.0 G PULLOUT
.06 SEC RELEASE INTERVAL
HOB – 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	WRCS C_B SETTING
500	20	5130	15	6.56	3680	– 8	7.9	16.4	280	350	720	1.52
		6840	20	8.12	5230	– 5	13.2	20.2	330	410	830	1.39
550	20	5130	15	6.26	3530	–10	6.8	15.5	280	340	690	1.67
		6840	20	7.64	5050	– 7	11.7	19.1	330	410	830	1.48
600	20	5130	15	6.14	3380	–11	5.9	14.8	260	330	660	1.85
		6840	20	7.40	4870	– 8	10.7	18.2	330	410	810	1.57
500	30	5000	10	4.54	3210	–22	3.7	11.1	160	190	390	1.77
		7500	15	4.60	5690	–22	8.9	14.9	250	290	580	1.37
		10000	20	7.06	7460	–17	13.4	19.1	290	360	720	1.38
550	30	5000	10	4.42	3070	–23	3.1	10.5	130	170	350	1.99
		7500	15	5.38	5210	–21	7.9	14.3	230	290	570	1.47
		10000	20	6.76	7250	–18	12.3	18.1	280	350	700	1.45
600	30	7500	15	5.26	5040	–22	7.1	13.6	220	270	540	1.57
		10000	20	6.58	7050	–19	11.5	17.3	270	340	680	1.52
500	45	10610	15	4.44	8000	–36	9.9	14.4	200	260	510	1.32
		14140	20	5.58	10930	–34	14.3	18.6	250	310	630	1.38
550	45	10610	15	4.32	7810	–37	9.1	13.7	190	240	480	1.38
		14140	20	5.40	10701	–35	13.4	17.7	240	300	600	1.45
600	45	10610	15	4.20	7650	–38	8.5	13.1	180	230	460	1.45
		14140	20	5.28	10490	–36	12.7	17.0	230	290	570	1.51

* MEAN POINT OF IMPACT

4C-34-1-1-(220-1)

Figure 6-21C (Sheet 1 of 9)

DIVE TOSS RIPPLE RELEASE F-4E (CONTINUED)

CBU-52B/B DISPENSER AND BOMB

2.0 G PULLOUT
.10 SEC RELEASE INTERVAL
HOB – 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	WRCS C_B SETTING
500	20	5130	15	6.50	3680	– 8	7.9	16.3	470	590	1190	1.52
		6840	20	8.10	5230	– 5	13.2	20.2	550	690	1370	1.39
550	20	5130	15	6.30	3530	–10	6.8	15.5	460	580	1150	1.67
		6840	20	7.70	5040	– 7	19.1	11.8	550	690	1380	1.48
600	20	5130	15	6.10	3390	–11	5.9	14.8	440	550	1090	1.85
		6840	20	7.40	4870	– 8	18.2	10.7	540	680	1360	1.57
500	30	5000	10	4.50	3230	–22	3.7	11.1	260	320	650	1.76
		7500	15	5.60	5370	–20	8.7	15.1	400	500	990	1.39
		10000	20	6.20	7690	–18	13.3	18.8	470	590	1170	1.37
550	30	7500	15	6.40	5210	–21	7.9	14.3	380	480	950	1.48
		10000	20	6.70	7270	–18	12.3	18.0	470	580	1170	1.45
600	30	7500	15	5.20	5070	–22	7.2	13.6	360	450	890	1.56
		10000	20	6.60	7040	–19	11.5	17.3	450	560	1130	1.52
500	45	10610	15	4.50	7970	–36	9.9	14.4	340	430	850	1.32
		14140	20	5.50	10970	–34	14.3	18.6	420	520	1050	1.38
550	45	10610	15	4.30	7820	–37	9.1	13.7	320	400	720	1.38
		14140	20	5.40	10700	–35	13.4	17.7	400	500	1000	1.45
600	45	10610	15	4.20	7650	–38	8.5	13.1	300	380	760	1.45
		14140	20	5.30	10470	–36	12.7	17.0	380	480	960	1.51

* MEAN POINT OF IMPACT

4C-34-1-1-(220-2)

Figure 6-21C (Sheet 2 of 9)

DIVE TOSS RIPPLE RELEASE F-4E (CONTINUED)

CBU-52B/B DISPENSER AND BOMB

2.0 G PULLOUT
.14 SEC RELEASE INTERVAL
HOB – 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE							DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	WRCS C_B SETTING
500	20	5130	15	6.58	3670	– 8	7.9	16.3	670	840	1670	1.52
		6840	20	8.12	5230	– 5	13.2	20.2	770	970	1920	1.39
550	20	5130	15	6.16	3550	–10	6.8	15.4	640	810	1610	1.67
		6840	20	7.70	5040	– 7	11.8	19.1	770	960	1920	1.48
600	20	5130	15	6.16	3370	–11	5.9	14.8	610	770	1530	1.85
		6840	20	7.42	4860	– 8	10.7	18.2	760	950	1900	1.57
500	30	5000	10	4.56	3200	–22	3.7	11.1	360	450	900	1.78
		7500	15	5.68	5350	–20	8.7	15.1	550	690	1390	1.39
		10000	20	7.08	7450	–17	13.4	19.1	670	840	1680	1.38
550	30	7500	15	5.40	5200	–21	7.9	14.3	530	670	1320	1.48
		10000	20	6.80	7240	–18	12.3	18.1	650	820	1640	1.45
600	30	7500	15	5.26	5040	–22	7.1	13.6	500	620	1250	1.57
		10000	20	6.52	7070	–20	11.5	17.3	630	790	1570	1.52
500	45	10610	15	4.48	7980	–36	9.9	14.4	480	600	1190	1.32
		14140	20	5.60	10910	–34	14.3	18.6	590	730	1460	1.38
550	30	7500	15	5.40	5200	–21	7.9	14.3	530	670	1320	1.48
		10000	20	6.80	7240	–18	12.3	18.1	650	820	1640	1.45
600	30	7500	15	5.26	5040	–22	7.1	13.6	500	620	1250	1.57
		10000	20	6.52	7070	–20	11.5	17.3	630	790	1570	1.52
500	45	10610	15	4.48	7980	–36	9.9	14.4	480	600	1190	1.32
		14140	20	5.60	10910	–34	14.3	18.6	590	730	1460	1.38
550	45	10610	15	4.34	7800	–37	9.1	13.6	450	560	1120	1.38
		14140	20	5.46	10660	–35	13.4	17.7	560	700	1400	1.45
600	45	10610	15	4.20	7650	–38	8.5	13.1	430	530	1060	1.45
		14140	20	5.32	10460	–36	12.7	17.0	530	670	1340	1.51

* MEAN POINT OF IMPACT

4C-34-1-1-(220-3)

Figure 6-21C (Sheet 3 of 9)

DIVE TOSS RIPPLE RELEASE F-4E (CONTINUED)

CBU-52B/B DISPENSER AND BOMB

3.0 G PULLOUT
.06 SEC RELEASE INTERVAL
HOB – 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	4 BOMB STICK (FT)	6 BOMB STICK (FT)	8 BOMB STICK (FT)	WRCS C_B SETTING
500	20	3420	10	3.98	2530	− 7	4.1	14.4	350	440	880	2.07
		5130	15	4.64	4180	− 5	10.6	18.6	460	570	1140	1.42
		6840	20	5.84	5860	0	16.9	23.4	480	600	1190	1.38
550	20	3420	10	3.98	2410	− 9	3.2	13.8	310	390	780	2.49
		5130	15	4.46	4060	− 7	9.4	17.6	540	570	1140	1.52
		6840	20	5.48	5700	− 3	15.1	22.0	500	630	1240	1.44
600	20	5130	15	4.34	3950	− 8	8.4	16.8	440	560	1110	1.64
		6840	20	5.72	5520	− 3	14.5	21.6	520	650	1290	1.54
500	30	5000	10	3.22	3760	−21	5.2	12.5	270	340	680	1.55
		7500	15	4.06	6020	−17	10.8	17.0	380	470	950	1.36
		10000	20	5.08	8290	−13	16.3	21.7	440	550	1100	1.37
550	30	5000	10	3.16	3640	−22	4.6	11.8	250	320	630	1.69
		7500	15	3.88	5900	−19	9.8	16.0	370	460	910	1.43
		10000	20	4.84	8130	−15	15.0	20.5	440	550	1090	1.44
600	30	5000	10	3.10	3530	−22	4.0	11.2	230	290	580	1.85
		7500	15	3.82	5760	−20	9.1	15.3	350	440	890	1.51
		10000	20	4.72	7970	−17	14.0	19.6	430	530	1060	1.52
500	45	5300	7.5	2.28	3950	−39	3.6	8.8	170	210	440	1.45
		7070	10	2.58	5560	−38	6.3	11.1	230	290	570	1.32
		10610	15	3.30	8710	−35	11.3	15.8	320	400	800	1.31
		14140	20	4.02	11900	−31	16.3	20.5	390	490	980	1.37
550	45	5300	7.5	2.22	3850	−40	3.2	8.2	160	200	390	1.54
		7070	10	2.52	5440	−39	5.7	10.5	270	320	590	1.38
		10610	15	3.18	8580	−36	10.5	15.0	310	380	760	1.37
		14140	20	3.90	11720	−33	15.3	19.6	370	470	930	1.44
600	45	7070	10	2.46	5330	−39	5.2	9.9	200	250	500	1.46
		10610	15	3.12	8440	−37	9.9	14.4	290	360	730	1.44
		14140	20	3.84	11530	−34	14.6	18.8	360	450	900	1.52

* MEAN POINT OF IMPACT

4C–34–1–1–(220–4)

Figure 6-21C (Sheet 4 of 9)

DIVE TOSS RIPPLE RELEASE F-4E (CONTINUED)

CBU-52B/B DISPENSER AND BOMB

3.0 G PULLOUT
.10 SEC RELEASE INTERVAL
HOB – 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	4 BOMB STICK (FT)	6 BOMB STICK (FT)	8 BOMB STICK (FT)	WRCS C_B SETTING
500	20	3420	10	4.00	2530	– 7	4.2	14.4	740	900	1630	2.07
		5130	15	4.60	4180	– 5	10.6	18.5	760	950	1890	1.42
		6840	7.0	5.80	5860	0	16.8	23.4	800	990	1990	1.38
550	20	3420	10	4.00	2410	– 8	3.2	13.8	520	660	1320	2.49
		5130	15	4.40	4070	– 7	9.3	17.5	750	950	1880	1.52
		6840	20	5.50	5700	– 3	15.1	22.0	840	1050	2080	1.45
600	20	5130	15	4.30	3960	– 8	8.4	16.8	730	920	1840	1.64
		6840	20	5.30	5550	– 5	13.9	20.9	840	1050	2100	1.53
500	30	5000	10	3.20	3760	–21	5.2	12.4	450	570	1130	1.55
		7500	15	4.10	6010	–17	10.8	17.0	630	800	1590	1.36
		10000	20	5.10	8290	–13	16.3	21.8	730	920	1830	1.37
550	30	5000	10	3.20	3630	–21	4.6	11.8	420	530	1050	1.69
		7500	15	3.90	5900	–19	9.8	16.1	610	760	1530	1.43
		10000	20	4.90	8120	–15	15.0	20.6	730	910	1820	1.44
600	30	5000	10	3.10	3530	–22	4.0	11.2	380	480	970	1.85
		7500	15	3.80	5770	–20	9.1	15.3	590	730	1470	1.51
		10000	20	4.70	7980	–17	14.0	19.6	710	880	1760	1.51
500	45	5300	7.5	2.30	3940	–39	3.6	8.7	280	350	700	1.45
		7070	10	2.60	5540	–38	6.2	11.1	380	480	960	1.32
		10610	15	3.30	8710	–35	11.3	15.8	530	670	1540	1.31
		14140	20	4.00	11900	–31	16.3	20.5	650	810	1630	1.37
550	45	5300	7.5	2.20	3860	–40	3.2	8.2	260	320	640	1.53
		7070	10	2.50	5450	–39	5.7	10.5	360	450	890	1.38
		10610	15	3.20	8570	–36	10.5	15.0	510	640	1280	1.37
		14140	20	3.90	11720	–33	15.3	19.6	620	780	1560	1.44
600	45	7070	10	2.40	5370	–40	5.2	10.0	330	420	830	1.45
		10610	15	3.10	8450	–37	9.9	14.4	480	610	1210	1.44
		14140	20	3.90	11500	–34	14.6	18.8	600	750	1490	1.52

* MEAN POINT OF IMPACT

4C-34-1-1-(220-5)

Figure 6-21C (Sheet 5 of 9)

DIVE TOSS RIPPLE RELEASE F-4E (CONTINUED)

CBU-52B/B DISPENSER AND BOMB

3.0 G PULLOUT
.14 SEC RELEASE INTERVAL
HOB – 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	4 BOMB STICK (FT)	6 BOMB STICK (FT)	8 BOMB STICK (FT)	WRCS CB SETTING
500	20	3420	10	4.06	2520	– 7	4.2	14.5	830	1050	2140	2.07
		5130	15	4.62	4180	– 5	10.6	18.5	1160	1330	2650	1.42
		6840	20	5.88	5850	0	16.9	23.5	1110	1390	2780	1.38
550	20	3420	10	4.06	2400	– 8	3.2	13.8	740	940	1930	2.49
		5130	15	4.48	4060	– 7	9.4	17.6	1060	1330	2650	1.52
		6840	20	5.46	5700	– 3	15.1	21.9	1160	1460	2910	1.45
600	20	5130	15	4.34	3950	– 8	8.4	16.8	1030	1300	2600	1.64
		6840	20	5.32	5550	– 5	13.9	21.0	1170	1470	2930	1.54
500	30	5000	10	3.20	3760	–21	5.2	12.4	630	790	1580	1.55
		7500	15	4.04	6030	–17	10.8	17.0	880	1110	2210	1.36
		10000	20	5.12	8280	–12	16.3	21.8	1030	1290	2560	1.37
550	30	5000	10	3.20	3630	–21	4.6	11.8	590	740	1470	1.69
		7500	15	3.90	5900	–19	9.8	16.0	850	1080	2140	1.43
		10000	20	4.84	8130	–15	15.0	20.5	1010	1270	2530	1.44
600	30	5000	10	3.06	3550	–23	4.0	11.2	540	680	1360	1.84
		7500	15	3.76	5780	–20	9.0	51.3	820	1030	2050	1.51
		10000	20	4.70	7970	–17	14.0	19.6	980	1240	2450	1.51
500	45	5300	7.5	2.32	3930	–39	3.6	8.7	400	500	990	1.46
		7070	10	2.66	5510	–38	6.2	11.1	530	670	1330	1.32
		10610	15	3.36	8680	–34	11.3	15.8	750	940	1880	1.31
		14140	20	4.06	11870	–31	16.3	20.5	910	1140	2270	1.37
550	45	7070	10	2.52	5440	–39	5.7	10.5	500	620	1240	1.38
		10610	15	3.22	8560	–36	10.5	15.0	710	890	1780	1.37
		14140	20	3.92	11700	–33	15.3	19.5	870	1090	2180	1.44
600	45	7070	10	2.52	5290	–39	5.1	9.9	460	580	1150	1.46
		10610	15	3.08	8460	–37	9.9	14.4	670	840	1680	1.44
		14140	20	3.78	11560	–34	14.6	18.8	830	1040	2080	1.51

* MEAN POINT OF IMPACT

4C-34-1-1-(220-6)

Figure 6-21C (Sheet 6 of 9)

DIVE TOSS RIPPLE RELEASE F-4E (CONTINUED)

CBU-52B/B DISPENSER AND BOMB

4.0 G PULLOUT
.06 SEC RELEASE INTERVAL
HOB – 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	4 BOMB STICK (FT)	6 BOMB STICK (FT)	8 BOMB STICK (FT)	WRCS C_B SETTING
500	20	3420	10	3.18	2720	– 6	5.3	15.3	510	640	1270	1.83
		5130	15	3.74	4390	– 3	11.9	19.7	600	760	1510	1.40
550	20	3420	10	3.12	2630	– 8	4.3	14.5	570	600	1180	2.10
		5130	15	3.56	4290	– 5	10.5	18.5	610	770	1580	1.48
		6840	20	4.40	5960	– 0	16.8	23.4	650	810	1620	1.44
600	20	3420	10	3.12	2540	– 9	3.6	13.9	430	540	1070	2.45
		5130	15	3.50	4200	– 7	9.6	17.8	610	770	1580	1.59
		6840	20	4.28	5840	– 3	15.5	22.3	660	830	1650	1.52
500	30	5000	10	2.68	3980	–19	6.0	13.1	360	470	930	1.50
		7500	15	3.34	6310	–15	11.9	18.0	510	640	1280	1.34
		10000	20	4.12	8660	–10	17.8	23.1	570	720	1430	1.36
550	30	5000	10	2.62	3880	–21	5.3	12.4	360	450	900	1.61
		7500	15	3.16	6210	–18	10.8	16.9	500	620	1240	1.41
		10000	20	3.94	8520	–13	16.4	21.8	580	730	1450	1.43
600	30	5000	10	2.56	3800	–22	4.7	11.8	330	420	840	1.74
		7500	15	3.10	6100	–19	10.0	16.2	480	600	1200	1.50
		10000	20	3.82	8390	–15	15.3	20.8	570	710	1420	1.51
500	45	5300	7.5	1.98	4140	–39	4.0	9.2	230	280	570	1.43
		7070	10	2.22	5780	–37	6.7	11.6	310	390	780	1.31
		10610	15	2.70	9070	–34	12.0	16.5	440	550	1090	1.31
		14140	20	3.30	12330	–28	17.3	21.5	520	660	1310	1.36
550	45	5300	7.5	1.92	4050	–40	3.6	8.5	210	270	520	1.50
		7070	10	2.10	5720	–38	6.1	10.9	290	370	730	1.36
		10610	15	2.64	8940	–35	11.2	15.7	410	520	1040	1.37
		14140	20	3.18	12190	–32	16.3	20.5	500	630	1260	1.43
600	45	5300	7.5	1.86	3980	–40	3.2	8.1	190	240	470	1.59
		7070	10	2.10	5590	–39	5.6	10.4	270	340	680	1.44
		10610	15	2.58	8820	–36	10.6	15.0	390	480	980	1.44
		14140	20	3.18	12000	–33	15.5	19.8	480	610	1210	1.51

* MEAN POINT OF IMPACT

4C-34-1-1-(220-7)

Figure 6-21C (Sheet 7 of 9)

CBU-52B/B DISPENSER AND BOMB

4.0 G PULLOUT
.10 SEC RELEASE INTERVAL
HOB – 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	4 BOMB STICK (FT)	6 BOMB STICK (FT)	8 BOMB STICK (FT)	WRCS C_B SETTING
500	20	3420	10	3.20	2720	– 6	5.3	15.3	850	1080	2140	1.83
		5130	15	3.70	4400	– 3	11.9	19.2	1000	1260	2500	1.39
550	20	3420	10	3.10	2640	– 8	4.3	14.4	780	990	1960	2.11
		5130	15	3.60	4290	– 5	10.7	18.7	1030	1290	2560	1.48
		6840	20	4.40	5960	– 0	16.8	23.4	1080	1350	2690	1.44
600	20	3420	10	3.10	2550	– 9	3.6	13.9	710	900	1790	2.46
		5130	15	3.50	4200	– 7	9.7	17.8	1010	1270	2520	1.59
		6840	20	4.30	5840	– 2	15.6	22.4	1110	1390	2760	1.53
500	30	5000	10	2.70	3970	–19	6.0	13.2	640	800	1600	1.50
		7500	15	3.40	6290	–15	11.8	17.9	850	1070	2130	1.34
		10000	20	4.10	8660	–10	17.8	23.1	950	1190	2380	1.36
550	30	5000	10	2.60	3890	–21	5.3	12.4	600	760	1520	1.61
		7500	15	3.20	6200	–17	10.8	17.0	830	1050	2080	1.41
		10000	20	3.90	8530	–13	16.3	21.7	1000	1210	2410	1.43
600	30	5000	10	2.60	3780	–22	4.7	11.8	560	710	1410	1.75
		7500	15	3.10	6100	–19	10.0	16.2	800	1000	2000	1.50
		10000	20	3.80	8390	–15	15.3	20.8	940	1190	2360	1.51
500	45	5300	7.5	2.00	4130	–39	4.0	9.1	380	480	940	1.43
		7070	10	2.20	5790	–37	6.7	11.6	530	660	1290	1.31
		10610	15	2.70	9070	–34	12.0	16.5	730	910	1820	1.31
		14140	20	3.30	12330	–30	17.3	21.5	870	1090	1280	1.36
550	45	5300	7.5	1.90	4070	–40	3.6	8.5	340	440	840	1.49
		7070	10	2.10	5720	–38	6.1	10.9	490	610	1180	1.36
		10610	15	2.60	8960	–35	11.2	15.7	690	870	1730	1.37
		14140	20	3.20	12180	–32	16.3	20.5	840	1050	2100	1.43
600	45	5300	7.5	1.90	3950	–40	3.2	8.1	310	---	---	1.60
		7070	10	1.90	5720	–40	5.7	10.4	450	560	1080	1.43
		10610	15	2.60	8810	–36	10.5	15.0	750	820	1640	1.44
		14140	20	3.20	11990	–33	15.5	19.8	810	1010	2020	1.52

* MEAN POINT OF IMPACT

4C-34-1-1-(220-8)

Figure 6-21C (Sheet 8 of 9)

CBU-52B/B DISPENSER AND BOMB

4.0 G PULLOUT
.14 SEC RELEASE INTERVAL
HOB – 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	4 BOMB STICK (FT)	6 BOMB STICK (FT)	8 BOMB STICK (FT)	WRCS CB SETTING
500	20	3420	10	3.18	2710	– 6	5.2	15.2	1180	1510	2970	1.83
		5130	15	3.75	4390	– 3	12.0	19.7	1410	1770	3530	1.40
550	20	3420	10	3.18	2620	– 8	4.4	14.6	1110	1420	2820	2.11
		5130	15	3.60	4290	– 5	10.6	18.6	1430	1800	3610	1.48
		6840	20	4.48	5960	0	17.0	23.6	1510	1890	3780	1.44
600	20	3420	10	3.18	2530	– 9	3.6	14.0	1010	1290	2580	2.47
		5130	15	3.46	4200	– 7	9.5	17.7	1390	1760	3520	1.59
		6840	20	4.20	5840	– 3	15.3	22.1	1530	1920	3850	1.52
500	30	5000	10	2.64	3990	–20	5.9	13.1	900	1140	2270	1.50
		7500	15	3.34	6300	–15	11.9	18.0	1200	1510	2990	1.35
		10000	20	4.18	8650	–10	17.9	23.3	1340	1680	3340	1.36
550	30	5000	10	2.64	3880	–21	5.3	12.4	850	1070	2140	1.61
		7500	15	3.20	6200	–17	10.8	17.0	1160	1470	2910	1.41
		10000	20	3.90	8530	–13	16.3	21.7	1420	1760	3520	1.43
600	30	5000	10	2.50	3820	–22	4.7	11.7	790	1000	1990	1.74
		7500	15	3.06	6110	–19	9.9	16.1	1110	1400	2830	1.50
		10000	20	3.76	8400	–15	15.2	20.7	1310	1650	3320	1.51
500	45	5300	7.5	1.90	4180	–39	4.0	9.1	510	650	1240	1.41
		7070	10	2.24	5760	–37	6.7	11.6	730	920	1770	1.31
		10610	15	2.80	9020	–33	12.1	16.6	1020	1280	2550	1.31
		14140	20	3.35	12290	–30	17.3	21.5	1220	1530	3050	1.36
550	45	5300	7.5	1.90	4070	–40	3.6	8.5	470	600	1140	1.49
		7070	10	2.10	5710	–39	6.1	10.9	670	840	1600	1.36
		10610	15	2.66	8920	–35	11.2	15.7	970	1220	2420	1.37
		14140	20	3.22	12160	–32	16.3	20.5	1170	1470	2940	1.44
600	45	7070	10	2.10	5590	–39	5.6	10.4	630	790	1510	1.44
		10610	15	2.66	8770	–36	10.5	15.0	920	1050	2210	1.44
		14140	20	3.22	11970	–33	15.5	19.7	1130	1410	2800	1.52

* MEAN POINT OF IMPACT

4C-34-1-1-(220-9)

Figure 6-21C (Sheet 9 of 9)

DIVE TOSS RIPPLE RELEASE F-4E

CBU-58/B or CBU-71/B DISPENSER and BOMB

2.0 G PULLOUT
.06 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			WRCS C_B SETTING
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	
500	20	5130	15	6.62	3670	-8	7.9	16.9	280	350	720	1.57
		6840	20	8.12	5230	-5	13.1	20.7	330	410	830	1.40
550	20	5130	15	6.38	3510	-9	6.8	16.1	280	350	690	1.74
		6840	20	7.70	5040	-7	11.8	19.6	330	420	830	1.49
600	20	5130	15	6.26	3350	-10	5.9	15.4	260	330	650	1.95
		6840	20	7.40	4870	-8	10.7	18.7	330	410	820	1.59
500	30	5000	10	4.68	3170	-22	3.6	11.7	150	190	370	1.93
		7500	15	5.70	5340	-20	8.7	15.6	240	300	590	1.42
		10000	20	7.08	7450	-17	13.4	19.5	290	360	720	1.38
550	30	7500	15	5.46	5180	-21	7.8	14.8	220	280	560	1.51
		10000	20	6.78	7240	-18	12.3	18.5	280	350	700	1.46
600	30	7500	15	5.28	5030	-22	7.1	14.1	210	270	530	1.61
		10000	20	6.60	7040	-19	11.4	17.7	270	340	670	1.53
500	45	10610	15	4.44	8000	-36	9.9	14.8	200	260	510	1.33
		14140	20	5.52	10960	-34	14.3	18.9	250	310	630	1.38
550	45	10610	15	4.32	7810	-37	9.1	14.0	190	240	480	1.40
		14140	20	5.34	10740	-35	13.4	18.1	240	300	600	1.44
600	45	10610	15	4.20	7650	-38	8.5	13.4	180	230	450	1.46
		14140	20	5.28	10490	-36	12.7	17.4	230	290	570	1.51

* MEAN POINT OF IMPACT

4C-34-1-1-(219-1)

Figure 6-21D (Sheet 1 of 9)

CBU-58/B or CBU-71/B DISPENSER and BOMB

2.0 G PULLOUT
.10 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	WRCS C_B SETTING
500	20	5130	15	6.60	3670	-8	7.9	16.9	470	600	1190	1.57
		6840	20	8.10	5230	-5	13.1	20.7	560	700	1380	1.40
550	20	5130	15	6.40	3510	-9	6.8	16.1	460	580	1150	1.74
		6840	20	7.70	5040	-7	11.8	19.6	550	690	1380	1.49
600	20	5130	15	6.20	3370	-11	5.9	15.4	440	570	1080	1.94
		6840	20	7.40	4870	-8	10.7	18.7	540	680	1360	1.59
500	30	5000	10	4.70	3160	-22	3.6	11.7	250	310	620	1.94
		7500	15	5.70	5340	-20	8.7	15.6	390	490	980	1.42
		10000	20	7.10	7450	-17	13.4	19.5	480	600	1200	1.38
550	30	7500	15	5.50	5170	-21	7.8	14.8	380	470	940	1.51
		10000	20	6.80	7240	-18	12.3	18.5	470	580	1170	1.46
600	30	7500	15	5.30	5030	-22	7.1	14.1	350	440	880	1.61
		10000	20	6.60	7040	-19	11.4	17.7	450	560	1120	1.53
500	45	10610	15	4.40	8020	-36	9.9	14.8	340	530	850	1.33
		14140	20	5.50	10970	-34	14.3	18.9	420	520	1050	1.37
550	45	10610	15	4.30	7820	-37	9.1	14.0	320	400	800	1.39
		14140	20	5.40	10700	-37	13.4	18.0	400	500	1000	1.44
600	45	10610	15	4.20	7650	-38	8.5	13.4	300	380	750	1.46
		14140	20	5.30	10470	-36	12.7	17.4	380	480	950	1.51

* MEAN POINT OF IMPACT

4C-34-1-1-(219-2)

Figure 6-21D (Sheet 2 of 9)

DIVE TOSS RIPPLE RELEASE F-4E (CONTINUED)

CBU-58/B or CBU-71/B DISPENSER and BOMB

2.0 G PULLOUT
.14 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			WRCS C_B SETTING
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	
500	20	5130	15	6.58	3670	-8	7.9	16.9	660	840	1670	1.57
		6840	20	8.12	5230	-5	13.1	20.7	770	970	1920	1.40
550	20	5130	15	6.44	3500	-9	6.8	16.1	640	810	1610	1.74
		6840	20	7.40	5040	-7	11.7	19.6	770	970	1940	1.49
600	20	5130	15	6.30	3340	-10	5.9	15.4	610	770	1530	1.95
		6840	20	7.42	4860	-8	10.7	18.8	760	950	1900	1.60
500	30	5000	10	4.68	3170	-22	3.6	11.7	350	430	870	1.93
		7500	15	5.66	5350	-20	8.7	15.6	550	690	1380	1.42
		10000	20	7.06	7460	-17	13.4	19.5	670	840	1680	1.38
550	30	7500	15	5.38	5210	-21	7.8	14.8	530	660	1310	1.51
		10000	20	6.78	7240	-18	12.3	18.5	650	820	1630	1.46
600	30	7500	15	5.24	5050	-22	7.1	14.1	490	610	1240	1.61
		10000	20	6.64	7030	-19	11.4	17.7	630	790	1570	1.53
500	45	10610	15	4.48	7980	-36	9.8	14.7	480	590	1180	1.33
		14140	20	5.60	10910	-34	14.2	18.9	590	730	1460	1.38
550	45	10610	15	4.34	7800	-37	9.1	14.0	450	560	1120	1.40
		14140	20	5.32	10740	-35	13.4	18.0	560	700	1390	1.44
600	45	10610	15	4.20	7650	-38	8.5	13.4	420	530	1060	1.46
		14140	20	5.32	10460	-36	12.7	17.3	530	670	1340	1.51

* MEAN POINT OF IMPACT

4C-34-1-1-(219-3)

Figure 6-21D (Sheet 3 of 9)

CBU-58/B or CBU-71/B DISPENSER and BOMB

3.0 G PULLOUT
.06 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	WRCS C_B SETTING
500	20	3420	10	4.10	2520	- 7	4.2	15.1	360	450	890	2.20
		5130	15	4.64	4180	- 5	10.6	19.1	460	570	1140	1.44
		6840	20	5.84	5860	0	16.9	23.9	480	600	1200	1.38
550	20	5130	15	4.46	4060	- 7	9.4	18.1	460	570	1140	1.55
		6840	20	5.48	5700	- 3	15.1	22.5	500	630	1260	1.45
600	20	5130	15	4.34	3950	- 8	8.4	17.4	440	550	1100	1.69
		6840	20	5.30	5550	- 5	13.8	21.4	510	640	1270	1.54
500	30	5000	10	3.34	3720	-20	5.2	13.1	270	340	670	1.64
		7500	15	4.06	6020	-17	10.8	17.4	380	470	940	1.37
		10000	20	5.08	8290	-13	16.3	22.1	440	550	1100	1.37
550	30	5000	10	3.22	3620	-21	4.5	12.3	250	310	620	1.80
		7500	15	3.94	5890	-19	9.8	16.6	370	460	910	1.45
		10000	20	4.84	8130	-15	15.0	21.0	440	550	1090	1.44
600	30	5000	10	3.22	3490	-22	4.0	11.8	230	280	570	2.01
		7500	15	3.82	5760	-20	9.0	15.8	350	440	880	1.54
		10000	20	4.72	7970	-17	14.0	20.1	430	530	1060	1.52
500	45	5300	7.5	2.34	3920	-39	3.6	9.2	170	210	420	1.54
		7070	10	2.58	5560	-38	6.2	11.5	230	280	570	1.35
		10610	15	3.30	8710	-35	11.3	16.2	320	400	810	1.32
		14140	20	4.02	11900	-31	16.2	20.8	390	490	980	1.36
550	45	7070	10	2.52	5440	-39	5.7	10.9	210	270	530	1.42
		10610	15	3.18	8580	-36	10.5	15.4	310	380	760	1.38
		14140	20	3.90	11720	-33	15.3	19.9	370	470	940	1.44
600	45	7070	10	2.46	5330	-39	5.2	10.3	200	250	490	1.50
		10610	15	3.12	8440	-37	9.9	14.7	290	360	720	1.45
		14140	20	3.84	11530	-34	14.5	19.1	360	450	900	1.51

* MEAN POINT OF IMPACT

4C-34-1-1-(219-4)

Figure 6-21D (Sheet 4 of 9)

DIVE TOSS RIPPLE RELEASE F-4E (CONTINUED)

CBU-58/B or CBU-71/B DISPENSER and BOMB

3.0 G PULLOUT
.10 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	WRCS C_B SETTING
500	20	3420	10	4.10	2520	- 7	4.2	15.1	590	750	1490	2.20
		5130	15	4.70	4180	- 4	10.7	19.2	760	960	1930	1.44
		6840	20	5.80	5860	0	16.8	23.8	800	1000	2000	1.38
550	20	5130	15	4.50	4060	- 7	9.4	18.2	760	960	1910	1.55
		6840	20	5.50	5700	- 3	15.1	22.5	840	1050	2090	1.45
600	20	5130	15	4.40	3940	- 8	8.5	17.4	740	930	1850	1.69
		6840	20	5.30	5550	- 5	13.8	21.4	850	1060	2110	1.54
500	30	5000	10	3.30	3730	-20	5.2	13.0	450	560	1120	1.64
		7500	15	4.10	6010	-17	10.8	17.5	630	800	1580	1.37
		10000	20	5.10	8290	-13	16.3	22.2	740	920	1840	1.37
550	30	5000	10	3.20	3630	-21	4.6	12.3	410	520	1030	1.79
		7500	15	3.90	5900	-19	9.8	16.5	610	760	1520	1.45
		10000	20	4.90	8120	-15	15.0	21.0	730	910	1820	1.44
600	30	5000	10	3.20	3490	-22	4.0	11.8	380	480	950	2.01
		7500	15	3.80	5770	-20	9.0	15.8	590	740	1460	1.54
		10000	20	4.70	7980	-17	14.0	20.1	710	890	1760	1.52
500	45	5300	7.5	2.30	3940	-39	3.6	9.2	280	350	690	1.53
		7070	10	2.60	5540	-38	6.2	11.5	380	470	950	1.35
		10610	15	3.30	8710	-35	11.3	16.2	540	670	1340	1.32
		14140	20	4.00	11900	-31	16.2	20.8	650	820	1630	1.36
550	45	7070	10	2.50	5450	-39	5.7	10.9	350	440	890	1.42
		10610	15	3.20	8570	-36	10.5	15.4	510	640	1270	1.38
		14140	20	3.90	11720	-33	15.3	19.9	620	780	1560	1.44
600	45	7070	10	2.50	5300	-39	5.2	10.3	330	410	820	1.51
		10610	15	3.10	8450	-37	9.9	14.7	480	600	1200	1.45
		14140	20	3.90	11500	-34	14.5	19.1	600	750	1490	1.51

* MEAN POINT OF IMPACT

4C-34-1-1-(219-5)

Figure 6-21D (Sheet 5 of 9)

DIVE TOSS RIPPLE RELEASE F-4E (CONTINUED)

CBU-58/B or CBU-71/B DISPENSER and BOMB

3.0 G PULLOUT
.14 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	WRCS C_B SETTING
500	20	3420	10	4.06	2520	- 7	4.2	15.0	820	1040	1890	2.21
		5130	15	4.62	4180	- 5	10.6	19.0	1060	1340	2660	1.45
		6840	20	5.88	5850	0	16.9	24.0	1120	1400	2800	1.38
550	20	5130	15	4.48	4060	- 7	9.4	18.1	1060	1330	2650	1.55
		6840	20	5.46	5690	- 3	15.0	22.4	1170	1470	2930	1.45
600	20	5130	15	4.34	3950	- 8	8.4	17.4	1030	1290	2570	1.69
		6840	20	5.32	5550	- 5	13.9	21.5	1180	1480	2950	1.54
500	30	5000	10	3.34	3720	-20	5.2	13.1	630	790	1570	1.64
		7500	15	4.04	6030	-17	10.8	17.4	880	1110	2210	1.37
		10000	20	5.02	8300	-13	16.2	22.1	1020	1280	2560	1.36
550	30	5000	10	3.20	3630	-21	4.5	12.3	580	720	1440	1.79
		7500	15	3.90	5900	-19	9.8	16.5	850	1060	2130	1.45
		10000	20	4.88	8120	-15	15.0	21.0	1020	1280	2540	1.44
600	30	5000	10	3.20	3490	-22	4.0	11.8	530	660	1330	2.01
		7500	15	3.76	5780	-20	9.0	15.8	820	1020	2030	1.54
		10000	20	4.74	7960	-17	14.0	20.1	990	1240	2470	1.52
500	45	5300	7.5	2.32	3930	-39	3.6	9.2	390	490	950	1.54
		7070	10	2.66	5510	-38	6.2	11.5	530	660	1320	1.36
		10610	15	3.36	8680	-34	11.3	16.2	750	940	1880	1.32
		14140	20	4.06	11870	-31	16.2	20.8	910	1140	2280	1.36
550	45	7070	10	2.52	5440	-39	5.6	10.9	490	620	1220	1.42
		10610	15	3.22	8560	-36	10.5	15.3	710	890	1780	1.38
		14140	20	3.92	11700	-33	15.2	19.8	870	1090	2180	1.44
600	45	7070	10	2.52	5290	-39	5.1	10.3	460	570	1140	1.51
		10610	15	3.08	8460	-37	9.8	14.7	670	840	1680	1.45
		14140	20	3.92	11480	-34	14.5	19.1	840	1050	2090	1.51

* MEAN POINT OF IMPACT

4C-34-1-1-(219-6)

Figure 6-21D (Sheet 6 of 9)

CBU-58/B or CBU-71/B DISPENSER and BOMB

4.0 G PULLOUT
.06 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	WRCS C_B SETTING
500	20	3420	10	3.24	2710	- 6	5.4	15.9	520	650	1300	1.92
		5130	15	3.72	4400	- 3	11.9	20.2	610	760	1520	1.41
550	20	3420	10	3.24	2620	- 7	4.5	15.2	490	620	1220	2.23
		5130	15	3.60	4300	- 5	10.7	19.2	610	780	1550	1.50
		6840	20	4.38	5970	0	16.8	23.9	650	820	1630	1.44
600	20	3420	10	3.24	2530	- 8	3.7	14.6	440	560	1100	2.64
		5130	15	3.48	4210	- 7	9.6	18.3	600	750	1510	1.62
		6840	20	4.26	5850	- 3	15.5	22.9	670	830	1670	1.53
500	30	5000	10	2.74	3960	-19	6.0	13.7	380	480	950	1.57
		7500	15	3.34	6310	-15	11.9	18.4	510	640	1280	1.36
		10000	20	4.12	8660	-10	17.8	23.6	580	720	1440	1.36
550	30	5000	10	2.68	3860	-20	5.3	13.0	350	440	890	1.69
		7500	15	3.22	6200	-17	10.8	17.5	500	630	1250	1.43
		10000	20	3.94	8520	-13	16.3	22.2	580	730	1460	1.43
600	30	5000	10	2.62	3770	-22	4.7	12.4	330	410	820	1.85
		7500	15	3.16	6080	-19	10.0	16.8	480	610	1200	1.52
		10000	20	3.82	8390	-15	15.3	21.2	570	710	1420	1.51
500	45	5300	7.5	1.98	4140	-39	4.0	9.6	230	290	560	1.50
		7070	10	2.20	5780	-37	6.7	12.0	310	390	780	1.34
		10610	15	2.70	9070	-34	12.0	16.9	440	550	1090	1.31
		14140	20	3.30	12330	-30	17.3	21.8	520	660	1310	1.35
550	45	5300	7.5	1.92	4050	-40	3.5	9.0	210	260	510	1.58
		7070	10	2.16	5680	-38	6.1	11.3	290	370	730	1.40
		10610	15	2.64	8940	-35	11.2	16.0	420	520	1040	1.37
		14140	20	3.18	12190	-22	16.3	20.8	510	630	1260	1.43
600	45	7070	10	2.10	5590	-39	5.6	10.8	270	340	670	1.48
		10610	15	2.60	8820	-36	10.5	15.4	390	490	980	1.44
		14140	20	3.12	12040	-33	15.4	20.0	480	610	1210	1.51

* MEAN POINT OF IMPACT

4C-34-1-1-(219-7)

Figure 6-21D (Sheet 7 of 9)

DIVE TOSS RIPPLE RELEASE F-4E (CONTINUED)

CBU-58/B or CBU-71/B DISPENSER and BOMB

4.0 G PULLOUT
.10 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	WRCS C_B SETTING
500	20	3420	10	3.20	2720	- 6	5.3	15.8	850	1080	2140	1.92
		5130	15	3.80	4390	- 2	12.1	20.4	1020	1270	2540	1.41
550	20	3420	10	3.20	2620	- 7	4.4	15.2	800	1020	2020	2.23
		5130	15	3.60	4290	- 5	10.7	19.2	1030	1300	2570	1.50
		6840	20	4.40	5970	0	16.8	23.9	1090	1360	2720	1.44
600	20	3420	10	3.20	2530	- 8	3.6	14.6	730	920	1830	2.65
		5130	15	3.50	4200	- 7	9.6	18.4	1010	1270	2530	1.62
		6840	20	4.20	5850	- 3	15.3	22.7	1110	1390	2770	1.53
500	30	5000	10	2.70	3970	-19	6.0	13.7	630	790	1580	1.56
		7500	15	3.30	6320	-15	11.8	18.4	850	1070	2130	1.35
		10000	20	4.10	8660	-10	17.7	23.5	960	1200	2390	1.36
550	30	5000	10	2.70	3860	-20	5.3	13.0	590	740	1490	1.70
		7500	15	3.20	6200	-17	10.8	17.4	830	1050	2080	1.43
		10000	20	3.90	8530	-13	16.3	22.2	970	1220	2420	1.43
600	30	5000	10	2.60	3780	-22	4.7	12.4	550	690	1380	1.85
		7500	15	3.10	6100	-19	9.9	16.7	800	1000	1990	1.52
		10000	20	3.80	8390	-15	15.2	21.2	950	1190	2370	1.51
500	45	5300	7.5	2.00	4130	-39	4.0	9.6	380	480	920	1.50
		7070	10	2.20	5790	-37	6.7	12.0	520	650	1280	1.34
		10610	15	2.70	9070	-34	12.0	16.9	730	910	1820	1.31
		14140	20	3.30	12330	-30	17.2	21.8	870	1090	2180	1.35
550	45	5300	7.5	1.90	4070	-40	3.6	9.0	340	430	830	1.58
		7070	10	2.10	5720	-38	6.1	11.3	480	610	1170	1.40
		10610	15	2.60	8960	-35	11.1	16.0	690	870	1730	1.37
		14140	20	3.20	12180	-32	16.2	20.8	840	1060	2110	1.43
600	45	7070	10	2.10	5590	-39	5.6	10.8	450	570	1100	1.48
		10610	15	2.60	8810	-36	10.5	15.4	660	820	1640	1.44
		14140	20	3.20	11990	-33	15.5	20.1	810	1010	2020	1.51

* MEAN POINT OF IMPACT

4C-34-1-1-(219-8)

Figure 6-21D (Sheet 8 of 9)

DIVE TOSS RIPPLE RELEASE F-4E (CONTINUED)

CBU-58/B or CBU-71/B DISPENSER and BOMB

4.0 G PULLOUT
.14 SEC RELEASE INTERVAL
HOB - 1800 FT AGL

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER			
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (1000 FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION TIME (SEC)	TIME RELEASE TO IMPACT (SEC)	5 BOMB STICK (FT)	6 BOMB STICK (FT)	11 BOMB STICK (FT)	WRCS C_B SETTING
500	20	3420	10	3.18	2710	- 6	5.2	15.7	1180	1500	2960	1.93
		5130	15	3.74	4390	- 3	11.9	20.2	1420	1780	3560	1.41
550	20	3420	10	3.18	2620	- 8	4.4	15.1	1100	1410	2800	2.25
		5130	15	3.60	4290	- 5	10.6	19.2	1440	1810	3620	1.50
		6840	20	4.44	5960	0	16.9	24.0	1520	1910	3800	1.44
600	20	3420	10	3.32	2510	- 8	3.7	14.7	1040	1350	2680	2.65
		5130	15	3.46	4200	- 7	9.5	18.2	1400	1770	3520	1.62
		6840	20	4.30	5840	- 3	15.5	22.9	1560	1950	3800	1.53
500	30	5000	10	2.78	3950	-19	6.0	13.8	890	1120	2240	1.57
		7500	15	3.34	6310	-15	11.9	18.4	1200	1510	3000	1.36
		10000	20	4.18	8650	-10	17.9	23.7	1350	1690	3360	1.36
550	30	5000	10	2.64	3880	-21	5.2	12.9	840	1060	2110	1.69
		7500	15	3.20	6200	-17	10.8	17.4	1160	1470	2910	1.43
		10000	20	3.90	8530	-13	16.3	22.1	1350	1700	3400	1.43
600	30	5000	10	2.64	3770	-21	4.7	12.4	780	980	1960	1.85
		7500	15	3.20	6070	-18	10.0	16.8	1130	1420	2820	1.52
		10000	20	3.76	8400	-15	15.2	21.1	1320	1660	3310	1.51
500	45	5300	7.5	2.04	4100	-38	3.9	9.6	530	660	1260	1.50
		7070	10	2.24	5760	-37	6.7	12.0	730	910	1760	1.34
		10610	15	2.80	9020	-33	12.0	16.9	1020	1280	2550	1.31
		14140	20	3.36	12290	-30	17.3	21.8	1220	1530	3060	1.36
550	45	5300	7.5	1.90	4070	-40	3.6	9.0	470	590	1120	1.58
		7070	10	2.10	5710	-39	6.1	11.3	660	830	1600	1.40
		10610	15	2.66	8920	-35	11.1	16.0	970	1210	2410	1.37
		14140	20	3.22	12160	-32	16.2	20.8	1180	1480	2940	1.43
600	45	7070	10	2.10	5590	-39	5.6	10.7	620	780	1500	1.48
		10610	15	2.65	8770	-36	10.5	15.4	920	1150	2290	1.45
		14140	20	3.22	11980	-33	15.4	20.0	1130	1420	2820	1.51

* MEAN POINT OF IMPACT

4C-34-1-1-(219-9)

Figure 6-21D (Sheet 9 of 9)

DIVE TOSS RIPPLE RELEASE

M36E2 INCENDIARY CLUSTER BOMB

2.0 G PULLOUT
0.10 SEC RELEASE INTERVAL
FUZE FUNCTION TIME - 6.0 SEC

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER		
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (FT)	PICKLE TO RELEASE -TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION ALTITUDE (FT)	TIME RELEASE TO IMPACT (SEC)	4 BOMB STICK (FT)	8 BOMB STICK (FT)	WRCS C_B SETTING
450	20	4000	11700	5.5	2860	- 9	1580	12.4	310	710	1.35
		4500	13160	6.4	3260	- 7	2130	15.1	300	700	1.54
		5000	14620	7.4	3680	- 5	2730	18.0	300	690	1.76
		5500	16080	8.6	4130	- 2	3390	21.1	290	670	2.02
500	20	4000	11700	4.9	2800	-11	1260	10.7	310	730	1.30
		4500	13160	5.7	3170	-10	1770	13.1	320	750	1.46
		5000	14620	6.6	3550	- 8	2310	15.7	320	750	1.66
		5500	16080	7.6	3950	- 6	2880	18.4	320	740	1.89
		6000	17540	8.6	4380	- 4	3480	21.2	310	730	2.15
550	20	4000	11700	4.6	2720	-13	1000	9.5	310	730	1.27
		4500	13160	5.2	3100	-12	1480	11.6	330	770	1.41
		5000	14620	6.0	3460	-10	1970	13.9	340	790	1.58
		5500	16080	6.8	3830	- 9	2480	16.3	340	790	1.79
		6000	17540	7.8	4200	- 7	3020	18.9	340	790	2.04
450	30	4500	9000	3.7	3170	-23	830	8.2	230	530	1.15
		5000	10000	4.1	3550	-22	1270	9.6	250	580	1.21
		5500	11000	4.6	3900	-21	1700	11.1	260	610	1.29
		6000	12000	5.1	4260	-20	2140	12.9	280	640	1.40
		6500	13000	5.6	4620	-19	2590	14.7	290	660	1.53
		7000	14000	6.2	4970	-17	3040	16.6	290	680	1.68
500	30	5000	10000	3.8	3480	-24	960	8.4	240	550	1.19
		5500	11000	4.2	3840	-23	1380	9.8	260	600	1.26
		6000	12000	4.6	4200	-22	1800	11.3	270	640	1.35
		6500	13000	5.1	4540	-21	2220	12.9	290	670	1.46
		7000	14000	5.6	4880	-20	2640	14.6	310	690	1.60
		7500	15000	6.2	5210	-18	3060	16.4	310	710	1.75
550	30	5500	11000	3.9	3780	-24	1080	8.7	250	550	1.24
		6000	12000	4.3	4120	-23	1480	10.7	270	620	1.32
		6500	13000	4.7	4470	-22	1890	11.5	280	660	1.42
		7000	14000	5.2	4790	-21	2290	13.1	300	690	1.54
		7500	15000	5.7	5110	-20	2690	14.7	310	720	1.68
		8000	16000	6.2	5440	-19	3100	16.3	310	740	1.83
450	45	6000	8490	3.0	4390	-39	950	7.8	180	410	1.14
		6500	9190	3.2	4780	-38	1370	8.8	190	450	1.18
		7000	9900	3.4	5180	-38	1780	9.9	210	480	1.23
		7500	10610	3.7	5530	-37	2170	11.0	220	520	1.29
		8000	11310	3.9	5930	-37	2590	12.3	230	550	1.37
500	45	6500	9190	3.0	4710	-40	990	7.8	180	420	1.17
		7000	9900	3.2	5090	-39	1390	8.8	190	450	1.21
		7500	10610	3.4	5480	-39	1780	9.9	210	480	1.26
		8000	11310	3.6	5860	-38	2210	10.9	220	520	1.33
550	45	7000	9900	3.0	5030	-40	1050	7.9	180	420	1.21
		7500	10610	3.2	5400	-40	1440	8.8	190	450	1.25
		8000	11310	3.4	5780	-39	1840	9.8	210	490	1.30

* MPI - Mean Point of Impact

4C-34-1-1-(218-1)

Figure 6-21E (Sheet 1 of 4)

DIVE TOSS RIPPLE RELEASE

M36E2 INCENDIARY CLUSTER BOMB

2.0 G PULLOUT
0.10 SEC RELEASE INTERVAL
FUZE FUNCTION TIME - 7.0 SEC

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER		
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION ALTITUDE (FT)	TIME RELEASE TO IMPACT (SEC)	4 BOMB STICK (FT)	8 BOMB STICK (FT)	WRCS C_B SETTING
450	20	4000	11700	5.3	2890	-10	1250	11.6	310	730	1.25
		4500	13160	6.1	3300	- 8	1820	14.2	310	730	1.38
		5000	14620	7.1	3700	- 5	2440	17.1	300	710	1.57
		5500	16080	8.1	4150	- 3	3080	20.1	290	690	1.78
500	20	4000	11700	4.8	2820	-12	920	10.1	320	740	1.23
		4500	13160	5.5	3200	-10	1440	12.3	330	770	1.33
		5000	14620	6.3	3590	- 8	1990	14.8	330	770	1.48
		5500	16080	7.2	3990	- 7	2560	17.5	330	760	1.67
		6000	17540	8.2	4400	- 5	3180	20.3	320	750	1.89
550	20	4000	11700	4.5	2740	-13	640	9.0	310	730	1.22
		4500	13160	5.1	3120	-12	1130	10.9	330	780	1.30
		5000	14620	5.8	3490	-10	1630	13.1	340	800	1.43
		5500	16080	6.5	3880	- 9	2150	15.4	350	810	1.59
		6000	17540	7.4	4250	- 7	2750	18.0	350	810	1.79
		6500	19010	8.3	4650	- 6	3290	20.6	340	800	2.02
450	30	5000	10000	4.1	3550	-22	820	9.1	240	570	1.16
		5500	11000	4.5	3930	-21	1270	10.5	260	610	1.21
		6000	12000	4.9	4310	-20	1730	12.1	280	640	1.28
		6500	13000	5.4	4670	-19	2180	13.8	290	670	1.38
		7000	14000	5.9	5040	-18	2650	15.7	290	690	1.50
		7500	15000	6.5	5400	-16	3120	17.6	300	700	1.63
500	30	5500	11000	4.1	3870	-23	920	9.3	240	590	1.20
		6000	12000	4.5	4230	-22	1350	10.6	270	630	1.26
		6500	13000	4.9	4600	-21	1790	12.1	290	670	1.34
		7000	14000	5.4	4940	-20	2220	13.8	300	700	1.43
		7500	15000	5.9	5290	-19	2660	15.5	310	720	1.55
		8000	16000	6.4	5650	-18	3110	17.3	310	730	1.69
550	30	6000	12000	4.2	4160	-23	1010	9.5	260	610	1.25
		6500	13000	4.6	4510	-22	1420	10.8	280	650	1.31
		7000	14000	5.0	4860	-22	1850	12.2	290	690	1.39
		7500	15000	5.4	5220	-21	2270	13.8	310	720	1.50
		8000	16000	5.9	5540	-20	2690	15.4	330	740	1.62
450	45	6500	9190	3.2	4780	-39	740	8.3	190	440	1.14
		7000	9900	3.4	5180	-38	1160	9.3	200	470	1.17
		7500	10610	3.6	5580	-38	1590	10.3	220	510	1.21
		8000	11310	3.8	5980	-37	2010	11.4	230	540	1.26
500	45	7000	9900	3.2	5090	-39	740	8.3	190	440	1.17
		7500	10610	3.3	5530	-39	1190	9.2	200	470	1.20
		8000	11310	3.5	5920	-39	1600	10.2	220	500	1.24
550	45	7500	10610	3.2	5400	-39	760	8.3	190	440	1.21
		8000	11310	3.3	5840	-40	1200	9.2	200	470	1.24

* MPI - Mean Point of Impact

4C-34-1-1-(218-2)

Figure 6-21E (Sheet 2 of 4)

DIVE TOSS RIPPLE RELEASE

M36E2 INCENDIARY CLUSTER BOMB

2.0 G PULLOUT
0.10 SEC RELEASE INTERVAL
FUZE FUNCTION TIME - 8.0 SEC

PICKLE CONDITIONS			MIDDLE BOMB IN RIPPLE RELEASE						DISTANCE BETWEEN MPI* OF FIRST AND LAST CLUSTER		
KNOTS TAS	DIVE ANGLE (DEG)	ALT AGL (FT)	SLANT RANGE (FT)	PICKLE TO RELEASE TIME (SEC)	RELEASE ALTITUDE (FT)	RELEASE ANGLE (DEG)	CLUSTER FUNCTION ALTITUDE (FT)	TIME RELEASE TO IMPACT (SEC)	4 BOMB STICK (FT)	8 BOMB STICK (FT)	WRCS C_B SETTING
450	20	4000	11700	5.2	2900	-10	900	11.0	320	740	1.19
		4500	13160	5.9	3320	- 8	1480	13.4	320	750	1.28
		5000	14620	6.8	3730	- 6	2100	16.2	320	740	1.42
		5500	16080	7.8	4160	- 4	2760	19.2	310	710	1.60
		6000	17540	8.9	4620	- 1	3480	22.5	290	690	1.80
500	20	4500	13160	5.4	3220	-10	1090	11.6	340	780	1.26
		5000	14620	6.1	3620	- 9	1640	14.0	340	790	1.36
		5500	16080	6.9	4020	- 7	2220	16.6	330	790	1.51
		6000	17540	7.8	4430	- 5	2840	19.4	330	770	1.69
		6500	19010	8.8	4870	- 3	3500	22.3	330	730	1.89
550	20	4500	13160	5.0	3140	-12	750	10.3	340	780	1.26
		5000	14620	5.6	3530	-11	1270	12.3	350	810	1.34
		5500	16080	6.3	3910	- 9	1800	14.6	350	820	1.46
		6000	17540	7.1	4290	- 8	2360	17.1	350	830	1.61
		6500	19010	7.9	4690	- 6	2940	19.6	350	820	1.80
		7000	20470	8.9	5100	- 5	3570	22.4	350	810	2.01
450	30	5500	11000	4.4	3960	-21	810	10.0	260	610	1.17
		6000	12000	4.8	4340	.20	1280	11.4	280	650	1.22
		6500	13000	5.2	4730	-19	1750	13.0	290	680	1.28
		7000	14000	5.7	5100	-18	2220	14.8	300	690	1.37
		7500	15000	6.2	5470	-17	2710	16.6	300	710	1.47
		8000	16000	6.8	5830	-16	3200	18.6	310	720	1.60
500	30	6000	12000	4.4	4270	-22	870	10.1	270	630	1.21
		6500	13000	4.8	4640	-21	1320	11.4	290	660	1.26
		7000	14000	5.2	5010	-20	1770	12.9	300	700	1.33
		7500	15000	5.6	5380	-20	2230	14.6	310	700	1.42
		8000	16000	6.1	5730	-19	2680	16.3	320	740	1.52
550	30	6500	13000	4.5	4540	-23	940	10.2	260	640	1.26
		7000	14000	4.8	4930	-22	1380	11.5	290	680	1.31
		7500	15000	5.2	5290	-21	1810	13.0	310	710	1.38
		8000	16000	5.6	5650	-20	2250	14.5	320	740	1.47
450	45	7500	10610	3.5	5630	-38	990	9.8	210	500	1.17
		8000	11310	3.7	6030	-37	1410	10.8	230	530	1.20
500	45	8000	11310	3.5	5920	-39	930	9.7	210	500	1.21

* MPI - Mean Point of Impact

4C-34-1-1-(218-3)

Figure 6-21E (Sheet 3 of 4)

DIVE TOSS RIPPLE RELEASE

M36E2 INCENDIARY CLUSTER BOMB

4.0 G PULLOUT									
PICKLE CONDITION			FUZE FUNCTION		PICKLE TO RELEASE TIME SEC	RELEASE		TIME RELEASE TO IMPACT SEC	CB SETTING
TAS KTS	DIVE ANG DEG	ALT AGL FT	ALT FT	TIME SEC		ALT FT	ANG DEG		
500	-30	5000	2000	5.6	2.60	4010	-20	12.04	1.41
550	-30	5000	2000	4.9	2.50	3934	-21	11.26	1.49
500	-30	6000	2000	8.0	2.80	4954	-18	14.00	1.36
550	-30	6000	2000	7.1	2.70	4867	-20	13.12	1.42
500	-30	7000	2000	10.4	3.10	5877	-16	16.06	1.35
550	-30	7000	2000	9.4	3.00	5774	-18	15.11	1.40
500	-45	7000	2000	6.4	2.10	5774	-38	10.79	1.28
550	-45	7000	2000	5.8	2.10	5649	-38	10.10	1.32
500	-45	8000	2000	7.9	2.30	6669	-36	12.27	1.29
550	-45	8000	2000	7.2	2.20	6589	-38	11.48	1.32
500	-45	9000	2000	9.5	2.40	7591	-35	13.73	1.30
550	-45	9000	2000	8.7	2.40	7473	-36	12.88	1.34

4C-34-1-1-(218-4)

Figure 6-21E (Sheet 4 of 4)

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BLU-66/B (CBU-46/A) LEFT DEFLECTION

OFFSET AIMPOINT COMPUTATION: THE EFFECT OF CROSSWIND AND BY THE SPIN MOTION OF THE BLU-66/B BOMB AFTER RELEASE MUST BE COMBINED TO OBTAIN THE CORRECT OFFSET AIMPOINT.

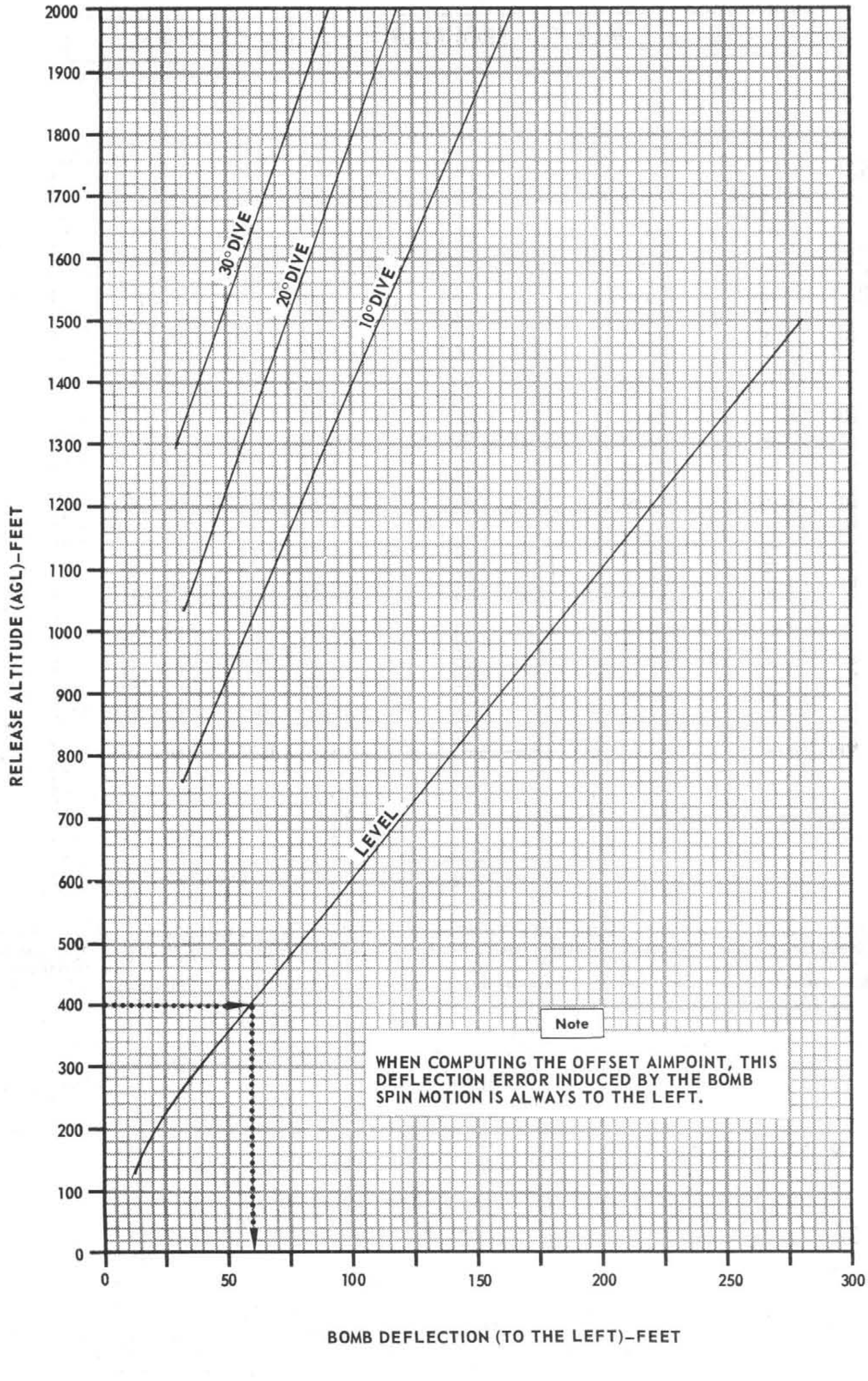

Figure 6-22

BLU-45/B CBU-33/A IMPACT LATERAL DISPLACEMENT

CBU-33/A MER TER SHOULDER POSITION CARRIAGE

RELEASE DIVE ANGLE DEG	RELEASE ALTITUDE FT	RELEASE KTAS		
		400	500	600
0	1500	82	75	70
0	2000	90	82	76
0	4000	120	109	100
0	6000	140	127	117
15	1500	62	55	50
15	2000	70	63	57
15	4000	104	94	86
15	6000	126	114	104
20	2000	68	60	54
20	3000	85	76	69
20	4000	100	89	81
30	2000	58	50	44
30	3000	76	67	60
30	4000	89	80	71
30	5000	103	92	83
45	3500	73	63	56
45	4000	79	68	61
45	6000	102	90	81
45	8000	122	109	98
45	10000	138	124	112
45	12000	152	137	123

Note

When the CBU-33/A is carried on the shoulder positions of either MERs or TERs, the BLU-45/B impact pattern will be displaced laterally in the direction of the side ejection. The magnitude of this lateral displacement in feet is induced by an effective lateral munition ejection velocity component of approximately 14 ft/sec (20 x sin 45°), as indicated in this tabulation. The lateral displacement distances listed are measured from the point of ejection and includes the release conditions provided in the CBU-33/A bombing tables.

F4-34-VI-123

Figure 6-23

BLU-49/B (CBU-38/A) IMPACT LATERAL DISPLACEMENT

CBU-38/A MER, TER SHOULDER POSITION CARRIAGE

RELEASE DIVE ANGLE DEG	RELEASE ALTITUDE FT	RELEASE AIRSPEED		
		400KTAS	500KTAS	600KTAS
0	1000	229 FT	218 FT	207 FT
0	1500	279	263	249
0	2000	319	299	282
0	2500	352	330	311
0	3000	382	357	335
0	3500	409	381	357
0	4000	433	403	377
0	4500	455	423	396
0	5000	476	442	413
0	5500	496	460	429
0	6000	514	477	444
15	1500	195 FT	175 FT	158 FT
15	2000	237	213	193
15	2500	272	246	224
15	3000	304	275	251
15	3500	332	301	276
15	4000	358	325	298
15	4500	382	347	319
15	5000	404	368	338
30	3000	245 FT	215 FT	191 FT
30	3500	273	240	214
30	4000	299	264	236
30	4500	323	287	257
30	5000	346	307	276
30	5500	367	327	295
30	6000	387	346	312
30	6500	406	336	329
30	7000	424	380	344
30	7500	441	398	359
30	8000	458	411	374
45	3500	233 FT	200 FT	175 FT
45	4000	258	223	196
45	4500	281	244	215
45	5000	304	264	234
45	5500	325	284	251
45	6000	344	302	268
45	6500	363	319	284
45	7000	382	336	300
45	7500	399	352	315
45	8000	416	368	329
45	8500	432	383	343
45	9000	447	397	357
45	9500	462	411	370
45	10000	476	424	383

Note

WHEN THE CBU-38/A IS CARRIED ON THE SHOULDER POSITIONS OF EITHER MER'S OR TER'S, THE BLU-49/B IMPACT PATTERN WILL BE DISPLACED LATERALLY IN THE DIRECTION OF THE SIDE EJECTION. THE MAGNITUDE OF THIS LATERAL DISPLACEMENT IN FEET IS INDUCED BY AN EFFECTIVE LATERAL MUNITION EJECTION VELOCITY COMPONENT OF APPROXIMATELY 44 FT/SEC (62 X SIN 45°), AS INDICATED IN THIS TABULATION. THE LATERAL DISPLACEMENT DISTANCES LISTED ARE MEASURED FROM THE POINT OF EJECTION AND INCLUDE THE RELEASE CONDITIONS PROVIDED IN THE CBU-38/A BOMBING TABLES.

F4-34-VI-124

Figure 6-24 NEW

GLOSSARY

A/A	Air-to-Air
AC	Aircraft Commander (front cockpit pilot). Formerly referred to as pilot.
A/G	Air-to-ground
AGC	Automatic Gain Control
AGL	Altitude above Ground Level
AGM	Air launched, Surface attack, guided missile.
AI	Airborne Intercept
AIM	Air launched, Intercept-aerial, guided missile.
Aimpoint	The preplanned point near or on the target that is used to align the pipper. Usually this is a point that is offset from the target to correct for the wind effect.
AN	A prefix to a Mark or Model designation to denote use by both Army/Air Force and Navy
Angle of Gun Fire (AGF)	The angle formed between the timed barrel line and the aircraft flight path (or relative airflow). The angle is used to determine trajectory shift.
Antenna Train Angle	The angle between interceptor heading and the bearing to the target.
AOJ	Acquire-On-Jam
API	Armor Piercing Incendiary
ASE	Allowable Steering Error
Aspect Angle	The sum of Antenna Train Angle and Track Crossing Angle.
Bezel	The scribes, marks, and numerals on the plastic overlay on the face of scope.
Blind Bombing	Bombing with the aid of radar and the WRCS Offset Bombing mode, without visual reference to the target.
BLU	Bomb Live Unit
Bore Line (BL)	A line through a gun barrel bore extending to infinity.
Boresighting	See Harmonization
BST	Boresight
CAS	Knots Calibrated Airspeed. The airspeed read on the calibrated airspeed indicator when the Air Data Computer is operating properly.
CBU	Cluster Bomb Unit
CEP	Circular Error Probability
CL	Centerline (Station 5)
DEP	Deflection (Cross Track) Error Probability
Dog Bone	The Multiple Weapons Control Panel on the F-4C aircraft.
EOD	Explosive Ordnance Disposal
EWO	Electronic Warfare Officer
FFAR	Folding Fin Aircraft Rocket
Flight Path	Aircraft attitude minus fuselage angle of attack.
Fire Bomb	Napalm, Anti-PAM (Personnel and Materiel), an incendiary munition.
FRL	Fuselage Reference Line.
Fuselage Angle of Attack	The angle in mils between the aircraft flight path and the fuselage reference line.
Fuselage Reference Line	The horizontal plane of the aircraft. The same as the water line, or the armament datum line, or zero water line.
GP Bomb	General Purpose bomb.
Ground Speed	The speed of the aircraft relative to the ground. (True airspeed plus or minus the rangewind component.)
Ground Track	The path or actual line of movement of the aircraft over the ground.
Harmonization	The adjustment (or boresighting) of the gun barrel so that, when the guns are fired at the most effective range (2250 feet) the pipper will be on the bullet impact point.
HE	High Explosive
HEAT	High Explosive Anti-tank
HOJ	Home-on-Jam
HVAR	High Velocity Aircraft Rocket
IAS	Knots Indicated Airspeed, as read on the calibrated airspeed indicator when the Air Data Computer is inoperative.
IP	Identification Point, visual or radar
IR	Infrared
LABS	Low Altitude Bombing System
LAU	Launcher Unit
Launch Factor (F)	A decimal value representative of rocket trajectory (a function of several variables). The product of (F) and launcher line angle of attack represents the angular rotation of the rocket from the launcher line toward flight path (mils).

GLOSSARY (Cont)

Launcher Line (LL)	The projected longitudinal axis of the launching tube, or the CL of the rocket in the tube.
Launcher Line Angle of Attack	The angle between the launcher line and relative airflow or aircraft flight path.
LDGP	Low Drag General Purpose bomb.
LI	Left Inboard (station 2).
LO	Left Outboard (station 1)
Line of Departure (LOD)	The initial path of a projectile after firing. This includes trajectory shift but not gravity drop.
LOS	Line of sight.
Mean Fixed Bore Line (MFBL)	An average of all bore lines in a common gun system and extending to infinity. The MFBL for gatling guns may also be defined as centerline of cluster.
Mean Parallax	When more than one gun is contained in a common system; mean parallax is the average linear distance or separation between sight and guns.
MER	Multiple Ejector Rack (Six ejector racks).
MIL	Milliradian. One mil=0.0573 degree. One degree=17.45 mils. Approximately one foot at 1000 feet.
MK	Mark. A designation for model.
MN	Mach Number
Mod	Modification
MSEC	Milliseconds, one msec=0.001 second.
MSL	Mean Sea Level
NM	Nautical Mile (6076.1 feet)
O/S	Over the Shoulder. The bomb is released at an angle greater than 90 degrees so that the bomb will fall back onto the target.
Parallax error	The error induced by the horizontal and vertical distance between the optical sight to gun, launcher, or bomb rack.
Passive Homing	The missile guides upon energy waves transmitted by the target. The missile does not transmit a signal that can be detected by the target, e.g., AIM-4D and AIM-9 missiles.
Pickle	The bomb release button, or the action of depressing the bomb release button.
Pilot/WSO	The pilot in the aft cockpit (also Weapons System Officer)
Pipper	The 2-mil diameter dot in the center of the optical sight reticle.
P_k	Probability of kill in percentage.
PLMS	Power Level Mode Switching.
PPI	Plan Position Indicator
Pressure Altitude	The altitude read on the pressure altimeter when set on 29.92 inches Hg.
PSO	Pilot Systems Operator, the pilot in the aft cockpit. Now referred to as PILOT.
Pulse Length	The transmission time or on time of a pulse radar set measured in microseconds.
Radar Boresight Line (RBL)	The position of the radar antenna when in BST (Boresight) and A/G (Air-to-ground). Two degrees below the Fuselage Reference Line.
Radar Mile	One radar mile equals 6000 feet. The radar mile is a unit of time (12.4 microseconds) that is required for one pulse of radar energy to be transmitted 6000 feet and be reflected back to the receiver.
Radar Silence	The radar is not transmitting, but in standby.
RBL	Radar Boresight Line. Two degrees below the fuselage reference line.
Rehoming	The act of positioning the release pulse to the first loaded station.
REP	Range Error Probability
RI	Right Inboard (station 8)
RIP	Radar Identification Point
RO	Right Outboard (station 9)
Semiactive Homing	A guidance concept where a missile receives and homes on reflected energy transmitted by the missile launching aircraft.
Sight Depression from Flight Path	The optical sight depression value in mils minus fuselage angle of attack.
Sight Picture	The relationship of the pipper position to the target.
Sight Setting	The value in mils that the optical sight is depressed.
Signal Strength	Level or size of the return on the radar scope.
SUU	Suspension and release Unit.
SW	Sidewinder (AIM-9B)
Target Elevation	The height of the target or IP above mean sea level (MSL).

GLOSSARY (Cont)

TAS	Knots true Airspeed. Calibrated airspeed corrected for temperature and pressure.
TDD	Target Detecting Device
TER	Triple Ejector Rack (Three ejector racks)
Timed Barrel Line (TBL)	A line extending to infinity through the bore in a timed barrel position. This line is used as a reference during gun/tracking index harmonization.
Track Crossing Angle	The angle between headings of the interceptor and the target.
Tracking Index (TI)	Optical Sight Pipper
Trajectory	Flight path of a projectile/bomb from firing/release to impact.
Trajectory Shift (TS)	The term used to define the amount of shift or angular rotation of a projectile when the timed barrel line and aircraft flight path (relative airflow) are not coincident.
Velocity Jump	The angle through which a rocket rotates - in the vertical plane - as it shifts into the relative airflow. The magnitude of the angle determines the Line of Departure (LOD), which is obtained by taking the product of the launch factor (F) and the launcher line angle of attack.
Video	Referring to the intelligence displayed on the radar scope.
VIP	Visual Identification Point
WRCS	Weapons Release Computer Set.
Zero Sight Line	When the optical sight is set on zero mils depression, the pipper line of sight is parallel to the fuselage reference line, or a water line.

REFERENCE

REFERENCE

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TACM 55-4	F-4 Aircrew Operational Procedures
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T.O. 1F-4C-1	F-4C/D/E Flight Manual
T.O. 1F-4C-2-12	Model F-4, Series C, Maint Instr - Air Data Computer Set - F-4C, D, RF-4C
T.O. 1F-4C-2-14	Model F-4, Series C, Maint Instr - Integrated Electronic Central AN/ASQ-19 and Radar Altimeter AN/APN-155 - F-4C, D
T.O. 1F-4C-2-15	Model F-4, Series C, Maint Instr - Navigation Sys - F-4C, D, RF-4C
T.O. 1F-4C-2-16	Model F-4, Series C, Maint Instr - Automatic Flt Control Sys - F-4C, D, RF-4C
T.O. 1F-4C-2-17	Model F-4, Series C, Maint Instr - Attitude Reference and Bombing Computer Sys - F-4C, D, RF-4C
T.O. 1F-4C-2-18	Armament Systems
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T.O. 1F-4D-2-19	F-4D Fire Control System
T.O. 1F-4D-2-33	Weapons Release Computer and Lead Computing Optical Sight System
T.O. 1F-4D-33-1-1	Model F-4, Series D (Depot Level), Basic Information - Conventional Munitions Loading Procedures - F-4D
T.O. 1F-4D-33-1-2	Model F-4, Series D (Depot Level), Conventional Munitions Loading Procedures - F-4D
T.O. 5N1-3-15-2	Weapons Release Computer Set AN/ASQ-91
T.O. 11-1-28	Armament Hazard Detecting and Personnel Ejection Sys and Associated Equipment Technical Orders - General - Bombs, Fins, Fuzes, Arming Wires and Related Components
T.O. 11-1-29	Tactical Munitions Manual for Bombs
T.O. 11-1-30	Tactical Munitions Manual for Rockets and Missiles
T.O. 11-1-31	Tactical Munitions Manual for Small-Arms Ammunitions
T.O. 11-1-32	Tactical Munitions Manual for Dispensers and Bombs (CBU)
T.O. 11-1-33	Armament, Fire Control Guidance, Hazard Detecting, Personnel Ejection Systems and Associated Equipment Technical Orders - General Safety Requirements - (Explosive)
T.O. 11A-1-1	Ammunitions, (Bombs and Fuzes) Restricted or Suspended
T.O. 11A-1-10-11	Ammunition Inspection Procedures - 20MM Electric Primed Ammunition
T.O. 11A-1-10-33	Ground Handling of Aircraft Containing Ammunition and Explosive Material
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T.O. 11A1-5-8-1	Operation and Org Maintenance Manual - Dispenser and Bomb CBU-2/A
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T.O. 11A5-8-1	SUU-7A/A Dispenser
T.O. 11A7-1-1	Fuzes, Proximity
T.O. 11A7-1-7	Fuzes, M905, M906
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T.O. 11A9-8-7	Storage, Handling, Assembly, Inspection and Disposal Procedures - Land Mine Type MLU-10/B
T.O. 11A10-1-1	Military Pyrotechnics
T.O. 11A11-2-7	Storage, Handling, and Inspection, Folding Fin Aircraft Rocket - 2.75 Inch and Components.
T.O. 11A13-4-7	Storage Handling and Inspection - 20MM Ammunition
T.O. 11A15-1-17	Storage, Handling, and Inspection - AGM-12B (Bullpup) Missile
T.O. 11A15-1-157	Storage, Handling, and Inspection - AGM-12B (Sidewinder) Missile
T.O. 11AA12	TDU-11/B HVAR Target Rocket
T.O. 11B1-AJB7-2	Type AJB7 Series, Field Maint. Instr - Attitude Reference Bombing Sys, Type AN/AJB-7 (Lear Siegler) - F-4C
T.O. 11C2-1-1	Fuzes, General Chemical Bombs
T.O. 11C2-2-3-7	Bomb Gas, Nonpersistent, GB, Bomb, 750 lb. Type MC-1
T.O. 11C2-2-4-7	Fuze, FMU-7/B
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T.O. 11L1-3-19-1	Type LAU-34/A Opr and Main Instr - Launcher, Type LAU-34/A (Martin) - AGM-12A.
T.O. 11L1-3-20-1	Type LAU-32A/A, LAU-32B/A, LAU-49/A Opr and Handling Instr for the Rocket Launcher, LAU-32A/A, P/N 63A-112J5 (Commercial Manual) - F-100, -104, -105, -111A T-28, B-57, F4C, A-1E
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T.O. 11W1-31-5-2	Type SUU-23/A, Field Maint Instr O/H - 20MM gun, Type SUU-23/A Pod
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T.O. 21M-AIM4A-01	Model AIM-4, Series A (Falcon), LOAP - Missiles and Equipment AIM-4A, B, C, D, E, F, G
T.O. 21M-AIM4D-2	USAF Model AIM-4D (Falcon) Missiles Assembly, Service and Maintenance
T.O. 21M-AIM4D-4	Model AIM-4, Series D (Falcon), Illustrated Parts Breakdown - AIM-4D
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